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A. B. CONNER, DIRECTOR

COLLEGE STATION, BRAZOS COUNTY, TEXAS

BULLETIN NO. 482 OCTOBER, 1933

DIVISION OF CHEMISTRY

Soils of Henderson, Hidalgo, Milam, Nacogdoches, Navarro, Wichita, Willacy, and Victoria Counties

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS
T. O. WALTON, President

Chemical analyses and some pot experiments are reported for representative samples of typical soils of Henderson, Hidalgo, Milam, Nacgdoches, Navarro, Victoria, Wichita, and Willacy counties. The bottom, or alluvial, soils are better supplied with plant food than the upland soils. Many of the soils are deficient in phosphoric acid and nitrogen. They are better supplied with potash, though some are low in potash. A few are low in lime with a tendency to become acid, but most are well supplied with lime and some are calcareous soils high in lime. [illegible] tations of the analyses of the individual soil ty[illegible]

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SOILS OF HENDERSON, HIDALGO, MILAM, NACOGDOCHES, NAVARRO, WICHITA, WILLACY AND VICTORIA COUNTIES

G. S. FRAPS

This Bulletin deals with the composition and fertility of samples of soils collected from eight counties in Texas. It is the thirteenth in a series dealing with the chemical composition of typical Texas soils.

Most of the samples were collected by field agents of the Bureau of Chemistry and Soils of the U. S. Department of Agriculture in cooperation with the Texas Agricultural Experiment Station. Detailed reports of these surveys with maps showing the location of the different soil types have been published by the Bureau of Chemistry and Soils of the U. S. Department of Agriculture. Descriptions of soils given in this Bulletin have been condensed from these reports. The soil surveys referred to are as follows:

Soil Survey of Henderson County, Texas by H. W. Hawker and R. E. Devereux.

Soil Survey of Hidalgo County, Texas by H. W. Hawker, W. M. Beck, and R. E. Devereux.

Soil Survey of Milam County, Texas by W. T. Carter, W. M. Beck, E. H. Templin, and H. W. Hawker.

Soil Survey of Nacgdoches County, Texas by B. H. Hendrickson, R. E. Devereux, and E. H. Templin.

Soil Survey of Navarro County, Texas by M. W. Beck and E. H. Templin.

Soil Survey of Wichita County, Texas by William T. Carter, W. W. Strike, H. V. Geib, and E. H. Templin.

Soil Survey of Willacy County, Texas by H. W. Hawker and C. S. Simmons, U. S. Department of Agriculture.

Soil Survey of Victoria County, Texas by W. T. Carter, C. S. Simmons, H. W. Hawker, and T. C. Reitch.

Requests for copies of these surveys should be addressed to the Bureau of Chemistry and Soils, United States Department of Agriculture, Washington, D. C.

MAINTENANCE OF FERTILITY

The following are some of the essentials to the maintenance or improvement of soil fertility:

1. The store of nitrogen and humus in the soil should be maintained. Growing legumes in a proper rotation, and turning these under or grazing them off is usually to be advised. The nitrogen in the soil may be supplemented by the use of nitrogenous fertilizers. Losses of nitrogen due to cropping eventually result in a deficiency of nitrogen.

2. Deficiency of phosphoric acid in the soil should be corrected by the use of phosphates as a fertilizer. Losses of phosphoric acid due to cropping eventually result in a deficiency of phosphoric acid.

3. Any acidity sufficient to be injurious to the crops being grown, if present, should be corrected by applications of ground limestone or lime. Lime and limestone are also used for the improvement of the physical character of heavy soils poor in lime or for supplying lime for crops which need a quantity of lime. Lime should be used chiefly in connection with a systematic rotation in which a suitable legume is included.

4. Any deficiency of potash in the soil should be corrected by the use of fertilizers containing potash. Losses of potash due to cropping eventually result in a deficiency of potash.

5. Erosion or washing away of the more fertile surface soil should be prevented.

6. Land under irrigation should have good underdrainage, either natural or artificial, so that salts dissolved in the irrigation water will be washed out and will not accumulate in the soil.

MAINTENANCE OF HUMUS AND NITROGEN

The maintenance of the humus, which is produced by the partial decay of vegetable matter in the soil, aids materially in maintenance of fertility. Humus, in sufficient quantity, helps soils to hold a favorable amount of water, so as better to resist drouth. It helps to give a fine crumbly structure to clay soils and enables them to break up into a good condition of tilth under the action of cultivating implements. It checks the rapidity of the percolation of water through sandy soils, thus decreasing loss of plant food. Humus also is the storehouse of most of the nitrogen of the soil. Nitrogen in humus is insoluble in water and cannot be taken up by crops or washed out of the soil. Nitrogen in humus is slowly changed by soil organisms to nitrates or ammonia, in which forms the nitrogen may be taken up by the plants or washed from the soil. The storing of nitrogen in the insoluble humus compounds protects the soil from rapid depletion of nitrogen, either by cropping or by percolating water.

Some soils produce good crops for a long time without additions of vegetable matter, but for permanent productiveness on most soils, vegetable matter must be added sooner or later. Vegetable matter may be supplied in barnyard manure, which is excellent when sufficient quantities can be secured, but barnyard manure cannot always be secured in large enough quantities. Artificial manure may be prepared from leaves, straw, or similar waste material. Legume crops, which have power to take nitrogen from the air, may be grown in rotation with other crops, and if either turned under or grazed off will introduce vegetable matter into the soil. If the crop is heavy, it is best to allow it to become nearly mature before turning it under. To graze off the crop is better than to turn it under, as some of the feeding value of the crop is secured when it is grazed, while the droppings from the animals, together with the liquid excrement, return to the soil the bulk of the plant food taken up by the crop. To make the crop into hay, and save the manure from the hay, is not as good for the soil as grazing off the crop, since a larger part of the plant food in the hay is lost in the liquid excrement or solid excrement which cannot be saved. When the legume is made into hay to be sold, the land probably gains little nitrogen and actually loses phosphoric acid and potash. Crops other than legumes add vegetable matter to the soil when plowed under or grazed off, or serve as cover crops to reduce losses from leaching or washing when the land would otherwise be bare, but legumes are the only plants known to take up the nitrogen of the air and place it into the soil in the forms suitable for use of other crops. For this reason it is best to grow legumes for hay, forage, or renovating crops whenever possible.

The maintenance of the nitrogen content of the soil is more important than the maintenance of its humus content. Nitrogen may be purchased as a fertilizer, but is expensive when bought in this way, and ordinarily a farmer growing staple crops cannot afford to buy enough of it to keep the nitrogen content of his land from decreasing. The only practical way to maintain nitrogen content of the soil when ordinary farm crops are grown is to secure part of the nitrogen from the air by growing legumes. The nitrogen fixed by the legumes can then be utilized for cotton, corn, kafir, or similar crops. The kind of legume best to grow depends upon the climate and other conditions, which vary with different sections of the State and with different conditions of farming.

Phosphoric Acid

Many Texas soils are deficient in phosphoric acid. This Bulletin contains information regarding the probable deficiencies in phosphoric acid of the various soils of the counties described. Deficiency of phosphoric acid may be easily and profitably corrected by the use of superphosphate as a fertilizer.

Acidity

Some soils contain organic or inorganic acids. Some crops such as clover, alfalfa, barley, and rye do not grow well on acid soils. There are other crops, such as cowpeas and watermelons, which do well on acid soils. Acidity may be corrected by the use of ground limestone, ground oyster shells, air-slaked lime, or hydrated lime. Few acid soils are found to occur in the counties described in this Bulletin. Legumes as a rule require more lime than other crops.

Potash

While many of the soils of Texas are rich in potash, there is a variation among the different soils and some need potash as a fertilizer. In general, potash is the least often needed of the three plant foods for field crops. Plants can take up more potash than they need.

The needs for potash of the various types of soil here studied are indicated by the tables of the analyses and of interpretation of the results given later. Some of the soils described are low in active potash compared with other soils of the State, though they are much better supplied with potash than with phosphoric acid or nitrogen.

HOW TO USE THE ANALYSES

Analyses of the soils are given in connection with the descriptions of the various types of soil in connection with each county. The interpretation of the analyses is also given so that the strength or weakness of each type can be ascertained.

If a soil well supplied with plant food does not give good yields it is obvious that some condition other than plant food controls the yields. The condition which limits the yield may be a poor physical condition, in respect to cultivation, drainage, or otherwise. It may be the presence of injurious substances, such as soluble salts or the soil may supply insufficient amounts of water for the plants. Plant diseases may also be present.

If the soil is well supplied with total plant food, but low in active plant food, attempts may be made to increase the activity of soil agencies which make the plant food available, by means of additions of manure, of green crops plowed under, or if the soil needs lime, by the addition of lime or ground limestone in connection with a legume rotation. This kind of cropping of course leads eventually to depletion of the plant food of the soil.

If the crop yields are low and the plant food is deficient, fertilizer should be used. It is not possible to tell from the chemical analyses of the soil the formula of the fertilizer which will give the best results. The depth of the soil and the character of the subsoil, as well as the season, influence the yield of crops as much as the plant food. The great variations caused by the season can be seen by observing the variation of the yield on the same land from one year to another.

EXPLANATION OF TERMS

Total phosphoric acid is the entire quantity of phosphoric acid contained in the soil. It cannot all be taken up by plants at once, as only a small portion is immediately available. It is made slowly available by natural agencies.

Active phosphoric acid is that part of the total phosphoric acid which is more easily taken up by plants. It is that soluble in 0.2N nitric acid. The relation of the active phosphoric acid to the strength of the soil is shown in the table giving the interpretation of the analyses. As shown in Bulletins 126 and 276, there is a relation between the active phosphoric acid of the soil and the amount of the phosphoric acid which crops are able to take from the soil in pot experiments. There is a closer relation between the active phosphoric acid of the soil and the needs of the soil for phosphoric acid as a fertilizer, than between the total phosphoric acid and the needs of the soil.

Total potash represents the entire amount of potash in the soil. A large part of this is locked up in highly insoluble silicates, and may not become available for the use of plants in centuries. The amount of total potash does not indicate how much is available for use by the immediate crop.

Acid-soluble potash is the amount of the potash that is dissolved by strong hydrochloric acid. As pointed out by Hilgard, there is a relation between the amount of acid-soluble potash of the soil and the wearing qualities of the soil (Fraps Principles of Agricultural Chemistry, Page 171). The higher the percentage of acid-soluble potash, the longer the soil can be cropped before it needs potash.

Active potash is the potash that can be readily taken up by plants, as shown by pot experiments in Bulletins 145 and 325. It is that soluble in 0.2N nitric acid. There is a close relation between the amount of active potash in the soil and the amount which can be used by crops.

Total nitrogen is the entire quantity present in the soil. Most of the nitrogen is present in organic matter or humus. As shown in Bulletin 151, there is a relation between the total nitrogen of the soil, and the nitrogen which can be taken from it by crops in pot experiments. The total nitrogen is therefore an index as to the needs of the soil for nitrogen, although the nitrogen in worn soils is not as valuable as that in new soils, and a number of conditions affect the quantity of nitrogen made available to the use of crops.

Acid-soluble lime is the lime which is dissolved by strong hydrochloric acid. According to Hilgard, the amount of lime found by this method is a valuable indication as to the fertility of the soil.

Basicity. The basicity represents the carbonate of lime and other basic materials in the soil. This term is here applied to the bases (chiefly lime) which neutralize the O.2N nitric acid in the method for dertermining active phosphoric acid and active potash. This term is merely used as a convenient one for the determination referred to. The basicity represents all the carbonate of lime, in addition to about 86 per cent of the exchangeable bases of the soil (Bulletin 442).

Acidity is here represented by what is termed the pH of the soil. The pH (or hydrogen ion concentration) shows the degree of acidity of the soil.

A neutral soil is represented by a pH value of 7.0. The lower the number below pH 7, the more acid the soil. A soil of pH 6.0 would be ten times more acid than a soil of 7.0, and one with 5.0 pH would be ten times more acid than one of pH 6.0. Numbers higher than 7.0 indicate alkalinity and the higher the number, the more alkaline the soil. In general, a certain reaction is best suited to a given kind of plant. If the soil is acid applications of lime should be made to produce the favorable pH, but soils do not all act alike in this respect, and sometimes acid soils do not respond to the use of lime.

Corn possibility represents the average amount of plant food which is withdrawn by plants in pot experiments from soils containing similar amounts of total nitrogen, active phosphoric acid, or active potash. It is based on 2,000,000 pounds of soil. The corn possibility is not claimed to indicate the possible yield from the soil, as this depends upon other conditions in addition to the fertility of the soil. The corn possibility is a convenient way of comparing amounts of various foods in the soil. For example, with the Susquehanna fine loam of Henderson County (No. 21888, Table 5) the corn possibility for total nitrogen is 18, for active phosphoric acid is 18, and for active potash 61. The soil is probably deficient both in phosphoric acid and in nitrogen. This may be compared with the Wilson clay loam of Henderson County, which has a corn possibility of 35 bushels for nitrogen, 33 for phosphoric acid, and 204 for potash. Other comparisons can be made from the tables.

The experiments on which this interpretation is based are published in Bulletins 126, 145, 151, 267, and 355, and the method is discussed in Bulletins 213 and 355.

Saline Soils

Saline soils are soils caused by the presence of soluble salts, chiefly sodium chloride or sodium sulphate. Soluble salts occur in some of the soils of the counties here discussed in sufficient quantity to be injurious to crops. Salty spots are of frequent occurrence along the Gulf Coast, and also in other parts of Texas. In some instances the soluble salts are of natural occurrence, as in soils along the sides of salty lakes or in spots, or even in larger areas. In other cases, the soluble salts accumulate as a result of irrigation or seepage water coming too near the surface. If the ground water can be brought sufficiently near the surface to evaporate, the soluble salts contained in it are left behind and accumulate. Where the accumulation of soluble salts is greater than the amount washed down by rain or irrigation water, the soil increases in saltiness, until there is so much salt that crops cannot be grown. Salty spots due to subirrigated areas occur in various sections of Texas. They may also be produced in yards or gardens by frequent sprinkling with irrigation water. The formation of saline spots may be prevented by drainage, so that the ground water is brought too low to rise and evaporate. Sufficient rain or irrigation water will then wash out any salt which may be present. Saline spots may be recovered by suitable drainage accompanied by sufficient applications of water to wash the salts through the soil into the country drainage; however, difficulties are met here, as the soil may be so heavy the water does not penetrate readily. The saline salts may also cause the soil particles to deflocculate and close up the pores of the soil so as to cause it to penetrate very slowly or even prevent the water from passing through.

Saline soils are frequently called **alkali soils.** The injurious salts are not alkaline as a rule, usually consisting of sodium chloride (common salt) and sodium sulphate. The salts are alkaline when sodium carbonate or bicarbonate is present, when they are called **black alkali.** Texas soils sometimes contain black alkali, but not frequently. The composition of some of the saline soils is given in connection with the discussion of soils of some of the counties.

POT EXPERIMENTS

The needs for plant food of some of the soils discussed in this Bulletin were studied by growing the plants in pots containing portions of the soils, to which various forms of plant food were added. In these experiments, 5,000 grams of soil were placed in galvanized iron pots, and to one or more pots, a complete fertilizer (NPK or NDK) was added. To one or more pots nitrogen and potash (NK) were added, phosphoric acid being omitted. The difference between this pot and the pot with complete fertilizer shows the need of the soil for phosphoric acid. To one or more pots, phosphoric acid and potash (PK) were added, nitrogen being omitted. The difference between this pot and that with the complete fertilizer shows the need of the soil for nitrogen. To the third set of one or more pots, nitrogen and phosphoric acid (NP) were added, potash being omitted. The difference between this pot and the pot receiving the complete fertilizer shows the need for potash.

The tables show the weights of the crops secured with the different additions, also the amounts of phosphoric acid, potash, or nitrogen removed from the pot by the plants grown in the experiments expressed in their equivalent of bushels of corn to the acre.

The soil in pot experiments is under favorable conditions, and it is possible for the plants to make a greater growth or to take up more plant food from the same quantity of soil than would be the case under field conditions. There might be a considerable difference between the crop receiving the complete fertilizer (KPN), and the crop which had no potash, (PN), in the amount of crop produced, and yet the crop produced without potash in the field might be equal to the possibility of production under the climatic conditions prevailing. Thus the soil would appear deficient in the pot experiment, while for all practical purposes it would not be deficient in the field. This is the reason why the plant food withdrawn is expressed in bushels of corn to the acre. It shows the relative possibility of the soil to furnish plant food for crops in pot experiments.

RELATION OF CHEMICAL ANALYSES TO PRODUCTION

Chemical analysis is made on samples of soil taken from the fields. The analysis for plant food represents the capacity of the soil to furnish it. The capacity of the soil to furnish plant food is only one of a group of factors which control production.

The chemical analysis is related to the capacity of the soil to supply plant food, but when application is made of the results to field work, other important factors enter into play. The most important of these are perhaps (a) the kind of crop and its ability to assimilate plant food, (b) the depth of the soil and the extent to which it is occupied by roots, (c) the water provided by soil and season, (d) the temperature, and (e) the highest quantity of crop which can be produced under these and other prevailing soil and climatic conditions. It is obvious that a plant having twice the capacity of another to assimilate phosphoric acid will need only half the quantity to be in the soil; that a soil furnishing enough phosphoric acid for 30 bushels of corn may not contain enough for 50 bushels; that a soil which can be occupied by roots to a depth of 6 inches furnishes only half as much plant food as one that is occupied to a depth of 12 inches; and that a soil may contain enough plant food for 30 bushels of corn and yet not enough for a large crop of tomatoes. These are all illustrations of the factors mentioned above, which affect the ability of the plant to use the food offered it by the soil.

The interpretations given in this Bulletin refer entirely to the capacity of the soil. No attempt is made to allow for any of the other factors which may affect production.

AVERAGE COMPOSITION OF THE SOILS OF THE COUNTIES STUDIED

For the purpose of discussion, the soils were in general divided into three main groups; the upland soils, the second-bottom, or high terrace soils, and the first-bottom, or alluvial, soils subject to overflow. In certain counties, the classification was more detailed. The average composition of these groups is given in Table 1.

The upland soils are averaged in several groups, as shown in Table 1. The Blackland Prairie upland soils, the dark-colored upland soils, and the calcareous upland soils are better supplied with plant food than the light-colored upland soils, or the other upland soils with friable or with heavy subsoils.

The difference is quite marked with nitrogen, as the better soils mentioned above contain twice as much nitrogen, or more, than the other upland soils. The difference is shown with phosphoric acid and potash also.

The upland soils of Henderson County, the upland soils of Milam County other than the Black Prairie, those of Nacogdoches County and Navarro County, again excepting the Black Prairie soils, the light-colored soils of Wichita County, and the soils of Victoria County, on an average are deficient in active phosphoric acid. The soils of Milam County and Henderson County, excepting the Black Prairie soils, the light-colored soils of Willacy County, and the upland soils of Victoria County, appear to be deficient in active potash. None of the soils are acid, on an average, with the exception of the timbered upland soils of Navarro County, which are slightly acid.

The terrace soils, those occupying flat to undulating old stream benches, above overflow, are in general somewhat better supplied with plant food than the upland soils. Those of Nacogdoches County are quite low in plant

Table 1. Average Composition of soils by groups

	Nitrogen per cent	Total phos. ac. per cent	Active phos. ac. per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH
Upland surface soils									
Henderson, Black Prairie	.114	.049	20	1.63	----	296	----	1.90	6.8
Henderson, friable subsoils	.040	.034	33	.78	.08	109	.13	.24	6.7
Henderson, heavy subsoils	.042	.026	17	.65	.12	102	.19	.25	6.3
Hidalgo county, dark-colored	.102	.089	189	1.52	.73	764	2.88	4.58	7.2
Hidalgo county, light-colored	.047	.034	56	1.32	.34	265	.27	1.67	7.2
Milam county, Black Prairie	.107	.056	65	.89	.36	288	2.44	2.63	6.9
Milam county, friable subsoils	.036	.029	20	.85	.09	111	.16	.32	6.4
Milam county, heavy subsoils	.043	.026	17	1.08	.10	112	.15	.27	6.7
Nacogdoches county	.044	.052	22	.50	.11	144	.10	.24	6.6
Navarro county, Black Prairie	.136	.078	153	1.45	.47	382	4.12	5.31	7.4
Navarro county, timbered, heavy subsoil	.050	.029	29	1.20	.09	159	.12	.21	6.2
Navarro, non-calcareous uplands	.063	.040	28	1.26	.29	205	.39	.83	6.6
Wichita county	.078	.053	92	1.38	.39	237	.60	1.35	7.1
Willacy county, dark-colored	.117	.113	386	2.48	.75	898	.99	2.04	7.5
Willacy county, light-colored	.021	.015	12	1.38	.09	101	.11	.25	6.6
Willacy county, semi-marshy	.099	.082	274	1.93	.69	681	1.95	3.54	7.3
Victoria county, flat coast prairie	.104	.027	32	.74	.39	235	1.14	1.44	6.3
Victoria county, upland prairie	.052	.020	18	.47	.09	106	.15	.25	6.5
Victoria county, upland calcareous	.128	.027	28	.65	.24	278	1.16	1.51	7.2
Terrace surface soils									
Henderson, East Texas timber	.046	.039	73	.74	.10	99	.17	.30	6.9
Henderson, Black Prairie	.130	.093	46	1.06	.69	308	1.29	2.20	6.7
Milam county	.102	.046	156	.98	.25	274	1.60	2.38	6.7
Nacogdoches county	.025	.024	30	.40	.06	84	.07	.25	6.5
Navarro county, calcareous	.101	.061	172	.96	.39	216	5.48	5.46	7.4
Navarro county, non-calcareous	.076	.029	32	.77	.24	169	.75	1.13	6.9
Victoria county	.149	.097	216	1.75	.55	401	5.70	9.67	7.6
Wichita county	.072	.066	204	1.72	.49	394	1.12	2.09	7.2
Alluvial surface soils									
Henderson county	.103	.052	54	1.33	.26	218	.43	.79	6.4
Hidalgo county	.122	.157	79	1.67	.80	475	11.46	19.57	7.2
Milam county	.083	.100	88	1.41	.62	251	5.91	12.84	7.2
Nacogdoches county	.103	.125	14	.67	.34	196	.27	.75	6.2
Navarro county, calcareous	.125	.103	281	1.19	.33	528	.88	5.06	7.3
Navarro county, non-calcareous	.056	.071	240	1.38		269	----	16.09	7.4
Victoria county	.124	.087	147	1.27	.51	266	8.60	16.09	7.4

Table 1. Average composition of soils by groups—Continued

	Nitrogen per cent	Total phos. ac. per cent	Active phos. ac. per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH
Alluvial surface soils—Continued									
Wichita county	.088	.077	267	2.15	.68	410	1.17	2.58	7.3
Willacy county	.063	.103	113	1.11	--	766	----	16.49	7.5
Upland subsoils									
Henderson, Black Prairie	.060	.045	16	1.73		216	----	2.15	7.7
Henderson, friable subsoils	.027	.030	15	.97	.13	121	.15	.20	6.4
Henderson, heavy subsoils	.031	.023	12	.74	.21	131	.22	.45	5.9
Hidalgo county (dark)	.072	.069	127	1.36	.75	559	3.53	6.03	7.3
Hidalgo county (light)	.035	.033	35	1.31	.38	270	.50	3.05	7.3
Milam county, Black Prairie	.071	.048	58	.93	.40	197	3.51	3.68	7.0
Milam county, friable subsoils	.038	.025	11	.80	.21	115	.24	.54	6.5
Milam county, heavy subsoils	.028	.020	10	1.18	.22	96	.14	.37	6.3
Nacogdoches county	.034	.054	12	.56	.19	129	.14	.31	6.3
Navarro county, Black Prairie	.098	.076	137	1.38	.36	221	6.97	6.20	7.5
Navarro county, timbered heavy subsoils	.040	.022	9	1.18	.25	208	.25	.60	6.0
Navarro county, non-calcareous uplands	.072	.037	43	1.30	.30	206	.49	1.02	6.5
Victoria county, flat coast	.070	.023	17	.99	.45	140	1.26	1.57	6.8
Victoria county, upland prairie	.042	.018	8	.54	.15	86	.25	.47	6.6
Victoria county, upland calcareous	.106	.022	15	.70	.33	170	1.97	3.68	7.2
Wichita county	.057	.047	65	1.29	.48	161	.71	2.00	7.3
Willacy county, dark	.075	.094	297	2.63	.68	688	1.89	3.69	7.5
Willacy county, light	.018	.015	9	1.42	.11	99	.10	.28	6.8
Willacy county, semi-marshy	.068	.080	253	2.10	.71	513	3.55	6.02	7.5
Terrace subsoils									
Henderson, East Texas timber	.021	.030	34	.81	.23	98	.23	.31	6.5
Henderson, Black Prairie	.071	.082	74	1.03	.63	224	3.33	4.95	7.3
Milam county	.062	.051	73	.74	.32	325	2.00	3.18	7.1
Nacogdoches county	.028	.025	8	.45	.20	139	.17	.40	6.7
Navarro county, calcareous	.062	.054	58	.95	.35	119	11.63	6.80	7.5
Navaro county, non-calcareous	.079	.038	93	.72	.24	147	.59	1.28	6.7
Victoria county	.112	.060	58	1.53	.44	121	7.20	13.20	7.7
Wichita county	.053	.054	161	1.79	.57	300	1.27	2.78	7.3
Alluvial subsoils									
Henderson county	.053	.032	25	1.39	.24	156	.39	.77	5.9
Hidalgo county	.091	.144	93	1.82	.82	353	12.17	19.71	7.2
Milam county	.065	.090	56	1.22	.68	199	6.11	12.92	7.4
Nacgdoches county	.103	.112	11	1.04	.35	134	.26	.80	6.7

Table 1. Average composition of soils by groups—Continued

	Nitrogen per cent	Total phos. ac. per cent	Active phos. ac. per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH
Alluvial subsoils—Continued									
Navarro county, calcareous	.110	.107	242	1.59	.40	391	1.48	4.57	7.3
Navarro county, non-calcareous	.045	.062	232	1.48	----	176	----	.98	6.7
Victoria County	.095	.074	73	1.21	.44	147	10.07	18.93	7.5
Wichita county	.061	.073	238	1.98	.75	268	1.37	3.13	7.2
Willacy county	.036	.086	148	1.11	----	181	----	12.50	7.5
Upland, deep subsoils									
Henderson, friable subsoils	.033	.028	10	1.07	.11	162	.14	.34	6.0
Nacogdoches county	.027	.031	7	.64	.25	140	.31	.46	6.2
Wichita county	.040	.043	65	1.18	.53	150	2.66	4.42	7.8
Terrace, deep subsoils									
Henderson, East Texas timber	.042	.039	10	.90	.36	196	.19	.38	6.3
Wichita county	.039	.045	40	1.57	.53	213	1.40	2.82	7.5
Alluvial, deep subsoils									
Milam county	.057	.092	84	1.60	.71	151	6.64	15.86	7.5
Wichita county	.051	.060	200	2.03	.74	192	1.41	2.90	7.4

food, including nitrogen, phosphoric acid, and potash, and are also slightly acid. The non-calcareous terrace soils of Navarro County are deficient in phosphoric acid, on an average.

The alluvial soils, or those on flat stream bottoms subject to overflow, are better supplied with plant food than the upland soils or terrace soils. Here again, those of Nacogdoches County are low in plant food, especially phosphoric acid.

CROP-PRODUCTION POWER OF AVERAGE SOILS

Table 2 contains the number of crops of 40 bushels of corn that could be produced by the plant food in an acre to the depth of 6 2/3 inches

Table 2. Number of crops of forty bushels of corn which would be produced by the plant food in two million pounds of soil (an acre 7 inches deep) (average soils)

Group	Nitrogen	Total phosphoric acid	Acid-soluble potash
Upland surface soils			
Henderson Black Prairie	38	39	—
Henderson friable subsoils	13	27	40
Henderson heavy subsoils	14	21	60
Hidalgo county (dark-colored)	34	71	365
Hidalgo county (light-colored)	16	27	170
Milam county, Black Prairie	36	45	180
Milam county, friable subsoils	12	23	45
Milam county, heavy subsoils	14	21	50
Nacogdoches county	15	42	55
Navarro county, Black Prairie	45	62	235
Navarro county, timbered heavy subsoil	17	23	45
Navarro, non-calcareous uplands	21	32	145
Victoria county, flat coast prairie	35	22	195
Victoria county, upland prairie	17	16	45
Victoria county, upland calcareous	43	22	120
Wichita county	26	42	195
Willacy county, dark-colored	39	90	375
Willacy county, light-colored	7	12	45
Willacy county, semi-marshy	33	66	345
Terrace surface soils			
Henderson, East Texas timber	15	31	50
Henderson, Black Prairie	43	74	345
Milam county	34	37	125
Nacogdoches county	8	19	30
Navarro county, calcareous	34	49	195
Navarro county, non-calcareous	25	26	120
Victoria county	50	78	275
Wichita county	24	53	245
Alluvial surface soils			
Henderson	34	42	130
Hidalgo county	41	126	400
Milam county	28	80	310
Nacogdoches county	34	100	170
Navarro county, calcareous	42	82	165
Navarro county, non-calcareous	19	57	—
Victoria county	41	70	255
Wichita county	29	62	340
Willacy county	21	82	—

(two million pounds), provided all the plant food could be extracted by the plants, in the groups of soils as averaged in Table 1. The total nitrogen of the upland soils could produce 7 to 45 crops of 40 bushels of corn, total phosphoric acid could produce 12 to 71 crops, and the acid-soluble potash could produce 40 to 375 crops. The terrace soils and the alluvial, or first-bottom, soils average much better, as can be seen in Table 2. It is seen that some of the soils have quite limited fertility. As these figures refer only to the top 7 inches of the soil and as the plants may draw on the subsoil, the possibility for actual crops is much greater than indicated above.

Table 3 contains the corn possibility of the groups, derived from Table 1. In the upland soils the corn possibility of the total nitrogen varies from 13 to 38 bushels, the active phosphoric acid from 12 to 50 bushels, and the active potash from 61 to 294 bushels. These figures show the importance of nitrogen and phosphoric acid in these soils, and that potash is less important.

FERTILIZERS FOR THE SOILS STUDIED

The soils studied may be divided into several groups with respect to their relation toward fertilizers.

The upland soils of all the counties excepting the dark-colored soils of Hidalgo County, the Black Prairie soils of Navarro County, the soils of Wichita County, and the dark-colored and semi-marshy soils of Willacy County, on the average, are somewhat low in phosphoric acid and some are decidedly deficient. Among the upland soils, the light-colored soils of Hidalgo County, the soils of Henderson County, and of Milam County except the Black Prairie, the soils of Nacogdoches County, those of Navarro County, except the Black Prairie, the light-colored soils of Willacy County, and the upland prairie soils of Victoria County are low in nitrogen. The upland soils of Milam County and Henderson County except the Blackland Prairie, those of Nacogdoches County, the light-colored soils of Willacy County, and the upland prairie soils of Victoria County are low in active potash. The use of fertilizers is generally advisable for field crops on the soils in the eastern part of the State. They are especially needed for truck and fruit crops. Fertilizers suggested for use are given in other publications of the Experiment Station. In general, the light soils are likely to need more potash than the heavier soils.

The black calcareous prairie soils, especially the Houston soils, do not respond well to fertilizers, and at present we cannot recommend fertilizers to be used on them, but recommend legume rotation and manure. Climate conditions may interfere with the profitable use of fertilizers in the western part of the State not under irrigation and they are not recommended in the absence of favorable field experiments.

The terrace soils are better supplied with plant food and generally do not need fertilizers so much as the upland soils, though some of those of Henderson, Nacogdoches, and Navarro counties may need fertilizer. The alluvial or first bottom soils are still better supplied with plant food.

Table 3. Interpretation of analyses of average soils

	Corn possibility two million pounds			Total phosphoric acid	Acid-soluble potash	Acid-soluble lime
	Active phosphoric acid	Total nitrogen	Active potash			
Upland surface soils						
Henderson, Black Prairie	12	33	135	fair	good	good
Henderson, friable subsoils	24	13	61	fair	low	fair
Henderson, heavy subsoils	12	18	61	low	fair	fair
Hidalgo county (dark-colored)	45	33	273	good	good	high
Hidalgo county (light-colored)	30	18	125	good	good	good
Milam county, Black Prairie	35	33	135	good	good	high
Milam county, friable subsoils	12	13	61	low	low	fair
Milam county, heavy subsoils	12	18	61	low	low	fair
Nacogdoches county	18	18	73	low	fair	low
Navarro county, Black Prairie	45	38	171	good	good	high
Navarro county, timbered, heavy subsoils	18	18	84	low	low	fair
Navarro, non-calcareous uplands	18	23	105	good	good	good
Victoria county, flat coast prairie	24	33	115	low	good	good
Victoria county, upland prairie	12	18	61	low	low	fair
Victoria county, upland calcareous	18	38	135	low	good	good
Wichita county	40	23	115	good	good	good
Willacy county, dark-colored	50	33	294	good	good	good
Willacy county, light-colored	12	13	61	low	low	fair
Willacy county, semi-marshy	50	28	256	good	good	good
Terrace surface soils						
Henderson, East Texas timber	35	18	50	fair	low	fair
Henderson, Black Prairie	30	38	144	good	good	good
Milam county	45	33	125	good	good	good
Nacogdoches county	18	13	50	low	low	low
Navarro county, calcareous	45	33	105	good	good	high
Navarro county, non-calcareous	24	23	84	low	good	good
Victoria county	50	43	180	good	good	high
Wichita county	50	23	171	good	good	good
Alluvial surface soils						
Henderson	30	33	105	good	good	good
Hidalgo county	35	38	196	good	good	high
Milam county	40	28	125	good	good	high
Nacogdoches county	12	33	94	good	good	good
Navarro county, calcareous	50	38	219	good	good	good
Navarro county, non-calcareous	50	18	125	good	good	fair
Victoria county	45	38	125	good	good	high
Wichita county	50	28	180	good	good	good
Willacy county	45	23	273	good	good	high

Where they produce a heavy growth of stem and leaves but do not fruit well, applications of superphosphate may correct this condition. Where the fertility has begun to decrease, on account of cultivation over a period of years, fertilizers will probably be of advantage. Fertilizers would be of advantage on vegetable crops.

USE OF LIME

Few of the soils described in this Bulletin are acid. Contrary to local opinion, lime is not needed on many of these soils. If lime is needed, it will be mentioned in the discussion of the soils of the county concerned.

The use of lime on sandy soils which are well drained, such as Norfolk, Ruston, or Orangeburg soils, is not to be advised except in connection with a legume rotation, for the reason that application of lime is likely to stimulate the production of nitrates and cause loss of nitrogen of the soils during the winter months. The acidity of these surface soils at the present time is generally not high enough to be injurious to crops ordinarily grown. They may become more acid under longer cultivation.

SOILS OF HENDERSON COUNTY

Henderson County is in east-central Texas and is chiefly in the geographical division termed the East Texas Timber Country but some of the western part of the county is in the Blackland Prairie. Forty-four types of soil were mapped in 22 series. The county also contains some peat soils. The most extensive soil is the Susquehanna fine sandy loam occupying 27.9 per cent of the area, followed by the Norfolk fine sand occupying 27.2 per cent, the Ochlockonee fine sandy loam on 10.5 per cent, and with Norfolk fine sandy loam on 7.0 per cent. The upland soils of the East Texas Timber Country with friable subsoils include the Norfolk, Greenville, Portsmouth, Ruston, Kirvin, and Bowie series. The upland soils with heavy subsoils include the Susquehanna, Lufkin, Wilson, and Crockett series. The terrace soils include the Kalmia, Leaf, Irving, Cahaba, and Bienville series. The flat stream bottoms include the Ochlockonee, Bibb, Johnston, and Trinity series. The Blackland Prairie soils, which are calcareous, include the Sumter and Houston soils of the uplands and the Bell soils of the terraces.

Composition of Soils

Table 4 gives the analyses of the different soil types and Table 5 an interpretation of the analyses. The soils of this county in general are somewhat low in plant food, especially nitrogen and phosphoric acid. The supply of potash is a little better. As usual, the uplands are lowest in plant food, the terraces come next, and the bottom lands are highest. The soils of the Blackland Prairie in general are better supplied with plant food than those of the East Texas Timber Country. Some of these

Table 4. Analyses of soils of Henderson County.

Laboratory number		Nitrogen per cent	Total phos. ac. per cent	Active phos. ac. per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH	Depth inches
21222	Bell clay	.130	.093	46	1.06	.69	308	1.29	2.20	6.7	0-10
21223	Bell clay	.071	.082	74	1.03	.63	224	3.33	4.95	7.3	10-36
21882	Bibb fine sandy loam	.063	.034	19	1.47	.09	66	.14	.20	5.8	0-12
21883	Bibb fine sandy loam	.037	.011	15	1.53	.11	63	.27	.30	5.5	12-36
21816	Bibb silty clay loam	.169	.053	56	1.70	.20	286	.08	.15	4.9	0-6
21817	Bibb silty clay loam	.104	.044	38	1.79	.14	182	.15	.09	4.8	6-36
21874	Bienville fine sand	.041	.043	120	1.28	.09	143	.18	.38	7.1	0-8
21875	Bienville fine sand	.018	.038	69	1.17	.08	111	.12	.25	6.7	8-36
21855	Bowie fine sandy loam	.051	.023	23	1.17	----	103	----	.22	6.9	0-12
21856	Bowie fine sandy loam	.025	.020	10	1.37	----	399	----	.40	7.1	12-20
21857	Bowie fine sandy loam	.044	.028	11	1.20	----	111	----	.33	5.9	20-36
21809	Cahaba fine sandy loam, deep phase	.060	.038	58	.65	.11	95	.18	.45	7.3	0-6
21810	Cahaba fine sandy loam, deep phase	.018	.030	26	.76	.11	96	.08	.05	6.6	6-20
21811	Cahaba fine sandy loam, deep phase	.042	.039	10	.90	.36	196	.19	.38	6.3	20-36
21820	Crockett clay loam	.043	.026	10	.80	.31	169	.32	.51	5.6	0-6
21821	Crockett clay loam	.030	.023	10	1.15	.40	185	.59	.75	6.1	6-36
21886	Greenville gravelly fine sandy loam	.051	.070	18	.64	----	199	----	1.08	7.0	0-12
21887	Greenville gravelly fine sandy loam	.048	.056	13	.82	.46	247	.27	.35	6.4	12-36
21872	Houston black clay	.109	.047	26	.83	----	258	----	2.70	7.3	0-10
21873	Houston black clay	.076	.035	16	.94	----	209	----	2.05	7.6	10-36
21862	Johnston clay	.118	.068	44	1.93	.54	300	1.02	1.95	5.8	0-18
21863	Johnston clay	.035	.035	31	1.80	.35	228	.76	1.58	6.7	18-36
21890	Kalmia fine sand	.035	.028	57	.58	----	40	----	.13	6.1	0-6
21891	Kalmia fine sand	.015	.028	25	.58	----	11	----	.15	6.4	6-36
21215	Kirvin fine sandy loam	.034	.056	21	.41	.07	96	.09	.20	7.3	0-6
21216	Kirvin fine sandy loam	.041	.067	13	.62	.21	149	.20	.45	6.5	9-36
21850	Kirvin fine sandy loam	.043	.032	14	1.01	----	89	----	.23	6.9	0-8
21851	Kirvin fine sandy loam	.058	.060	11	1.26	----	199	----	.33	5.5	8-24
21852	Kirvin fine sandy loam	.033	.040	11	1.20	----	197	----	.30	5.8	24-36
11253	Kirvin fine sandy loam, probably	.040	.029	12	----	.10	140	.55	.19	----	0-10
11254	Kirvin fine sandy loam, probably	.017	.021	11	----	.09	91	.16	.12	----	10-20
21807	Kirvin gravelly fine sandy loam	.064	.043	19	.30	.10	107	.10	.33	6.6	0-10
21808	Kirvin gravelly fine sandy loam	.038	.041	8	.59	.21	106	.05	.33	5.5	10-36
21812	Leaf fine sandy loam	.046	.048	55	.45	.09	116	.16	.23	6.9	0-10
21813	Leaf fine sandy loam	.034	.024	15	.73	.49	174	.40	.80	6.4	10-36
21803	Lufkin fine sand	.029	.014	11	.19	.07	66	.08	.00	5.9	0-16
21804	Lufkin fine sand	.012	.013	11	.42	.07	30	.06	.20	6.5	6-36
21217	Lufkin very fine sandy loam	.048	.014	19	.75	.08	131	.20	.25	6.9	0-6

Laboratory number		Nitrogen per cent	Total phos. ac. per cent	Active phos. ac. per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH	Depth inches
21218	Lufkin very fine sandy loam	.029	.013	19	.60	.21	335	.44	.75	6.3	6-36
21783	Norfork fine sand	.026	.036	109	.85	.05	105	.07	.14	7.0	0-10
21784	Norfork fine sand	.012	.031	40	.84	.06	113	.09	.09	7.2	10-36
3379	Norfolk fine sand, probably	.031	.017	16	----	.13	268	.11	.20	----	0-10
3380	Norfolk fine sand, probably	.027	.016	12	----	.11	73	.14	.10	----	10-20
9271	Norfolk fine sand, probably	.033	.046	15	----	.05	80	.06	.12	----	0-6
9272	Norfolk fine sand, probably	.015	.034	7	----	.08	60	.08	.15	----	6-18
9809	Norfolk fine sand, probably	.036	.038	18	----	.07	69	.05	.15	----	0-12
9810	Norfolk fine sand, probably	.030	.031	6	----	.06	36	.10	.05	----	12-24
12959	Norfolk fine sand, probably	.035	.067	61	----	.06	115	.08	.14	----	0-4
12960	Norfolk fine sand, probably	.019	.028	30	----	.08	86	.23	.14	----	4-8
21785	Norfolk fine sandy loam	.020	.022	11	.45	.05	118	.21	.07	6.9	0-18
21786	Norfolk fine sandy loam	.028	.032	11	.82	.22	205	.21	.28	6.6	18-36
21814	Norfolk fine sandy loam	.037	.033	22	.45	.09	82	.11	.13	7.1	0-12
21815	Norfolk fine sandy loam	.036	.027	8	.72	----	136	----	.29	5.9	12-36
4581	Norfolk fine sandy loam, probably	.059	.048	72	----	.06	166	.11	.56	----	0-18-20
4582	Norfolk fine sandy loam, probably	.027	.020	32	----	.06	146	.12	.20	----	18-20-30-33
5098	Norfolk fine sandy loam, probably	.045	.025	36	.63	.08	----	.12	.58	----	0-6
5099	Norfolk fine sandy loam, probably	.019	.008	14	.57	.06	84	.28	.05	----	6-12
21224	Norfolk sand	.010	.020	30	.17	.08	28	.07	.10	6.7	0-6
21225	Norfolk sand	.012	.019	15	.31	.08	23	.09	.10	6.8	6-36
21876	Ochlockonee fine sand	.050	.051	116	.88	----	112	----	.28	6.4	0-6
21877	Ochlockonee fine sand	.022	.041	48	1.45	----	100	----	.15	6.1	6-36
21870	Ochlockonee fine sandy loam	.042	.037	36	1.53	.15	131	.23	.78	7.1	0-12
21871	Ochlockonee fine sandy loam	.054	.031	17	1.45	.22	97	.32	.85	5.7	12-36
21868	Ochlockonee silty clay loam	.145	.077	53	1.43	.35	268	.58	1.10	6.3	0-6
21869	Ochlockonee silty clay loam	.064	.056	39	1.51	.37	208	.35	.75	5.7	6-36
21805	Ochlockonee very fine sandy loam	.095	.052	23	1.09	.16	167	.21	.50	6.5	0-8
21806	Ochlockonee very fine sandy loam	.092	.038	21	1.09	.15	123	.23	.65	6.4	8-36
21884	Orangeburg fine sandy loam	.033	.030	23	1.35	----	105	----	.15	6.8	0-12
21885	Orangeburg fine sandy loam	.029	.030	14	1.65	----	123	----	.25	6.8	12-36
21864	Peat	.714	.136	----	1.19	----	----	----	----	4.2	0-18
21865	Peat	.524	.111	----	1.53	----	----	----	----	4.6	18-36
21866	Portsmouth fine sand	.115	.035	24	1.34	----	49	----	.15	4.7	0-12
21867	Portsmouth fine sand	.023	.019	18	1.63	----	32	----	.08	6.0	12-36
21860	Ruston fine sand	.024	.026	23	.66	----	103	----	.12	6.9	0-15
21861	Ruston fine sand	.019	.039	10	.97	----	73	----	.10	6.7	15-36

Table 4. Analyses of soils of Henderson County—Continued.

Laboratory number		Nitrogen per cent	Total phos. ac. per cent	Active phos. ac. per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH	Depth inches
21219	Ruston fine sandy loam	.016	.012	15	.87	.06	56	.09	.10	6.8	0-8
21220	Ruston fine sandy loam	.009	.014	26	.62	.06	52	.07	.10	7.0	8-24
21221	Ruston fine sandy loam	.023	.015	9	.80	.11	178	.14	.40	6.3	24-36
21880	Ruston fine sandy loam	.031	.016	15	1.38	——	100	——	.15	6.5	0-8
21881	Ruston fine sandy loam	.031	.020	14	1.69	——	116	——	.33	5.9	8-36
21878	Sumter clay loam	.118	.051	14	2.42	——	333	——	1.10	6.2	0-6
21879	Sumter clay loam	.044	.054	16	2.51	——	223	——	2.25	7.7	6-36
21888	Susquehanna fine sandy loam	.050	.025	29	.85	.08	120	.10	.15	6.0	0-8
21889	Susquehanna fine sandy loam	.039	.025	16	.82	.28	185	.16	.60	5.5	8-36
13246	Susquehanna fine sandy loam, probably	.032	——	8	——	——	61	.23	.24	6.7	0-12
13247	Susquehanna fine sandy loam, probably	.032	——	8	——	——	55	.10	.24	4.7	12-24
9302	Susquehanna fine sandy loam, probably	.041	.033	32	——	.05	79	.20	.27	6.7	0-5
9303	Susquehanna fine sandy loam, probably	.030	.030	16	.61	.05	59	.13	.10	6.7	5-16
9179	Susquehanna fine sandy loam, probably	.052	.041	12	——	.10	88	.22	.32		0-6
9180	Susquehanna fine sandy loam, probably	.044	.031	6	.86	.22	70	.04	.51	5.2	6-18
21853	Trinity fine sandy loam	.170	.055	112	1.46	——	265	——	.88	7.7	0-6
21854	Trinity fine sandy loam	.030	.023	19	1.46	——	229	——	.95	5.7	6-36
21818	Wilson clay	.103	.055	65	1.08	.33	492	.77	1.45	7.0	0-6
21819	Wilson clay	.039	.022	12	.97	.33	205	.68	1.30	5.9	6-36
21858	Wilson fine sandy loam	.077	.034	20	.75	——	90	——	.63	6.2	0-12
21859	Wilson fine sandy loam	.057	.023	14	.81	——	129	——	1.03	6.3	12-36

latter soils are low in lime and a few of them are acid, especially those of the Bibb series. In general, the soils of this county are not acid at the present time except to a slight extent. Nitrogen and phosphoric acid are needed on most of these soils and potash is likely also to be needed on many of them. While lime is not needed on most of the East Texas Timber Country soils for crops generally grown, it is likely to be needed on many of them after they have been in cultivation for a longer period of time or for certain legume crops such as clover.

Pot Experiments

Pot experiments are given in Table 6. It is noted that most of these soils respond to phosphoric acid and nitrogen in pot experiments but practically none of them respond to potash.

Fertilizers

The need for fertilizers carrying nitrogen, phosphoric acid, and, usually, potash is indicated on many of these soils, especially the upland soils of the East Texas Timber Country. Lime is at present not needed on most of the soil but may be needed for legume crops or after the soils have been in cultivation for a longer period of time.

Classification of Soils of Henderson County

Upland Soils, East Texas Timber Country:

Light brown to grayish-brown topsoil with red heavy clay subsoils, slowly permeable—Kirvin soils.

Gray to light-brown topsoil with yellow subsurface, and yellow mottled with gray and red permeable subsoils—Bowie soils.

Light-brown to grayish with brown topsoil with very permeable reddish-yellow or reddish-brown subsoils—Ruston soils.

Gray topsoil with yellow subsurface and yellow sandy subsoil, very permeable—Norfolk soils.

Reddish-brown or light brownish-red topsoil with deep-red permeable subsoil—Greenville soils.

Dark-gray topsoil with dull-gray sandy subsoil, soil poorly drained—Portsmouth soils.

Gray topsoil, tight on drying, with dense, gray, slowly permeable subsoil—Lufkin soils.

Light-brown to gray topsoil with yellow subsurface and red and gray mottled, dense slowly permeable subsoil—Susquehanna soils.

Black to brown topsoil with brown, yellow, and mottled red and gray subsoil—Crockett soils.

Flat to Undulating Old Stream Benches, above Overflow:

Light-brown topsoil with reddish or yellowish subsurface, with light-red, very permeable subsoil—Cahaba soils.

Table 5. Interpretation of analyses of surface soils of Henderson county

Laboratory number		Corn possibility two million pounds: Active phosphoric acid	Corn possibility two million pounds: Total nitrogen	Corn possibility two million pounds: Active potash	Total phosphoric acid	Acid-soluble potash	Acid-soluble lime
21222	Bell clay	30	38	144	good	good	good
21882	Bibb fine sandy loam	12	23	38	fair	low	fair
21816	Bibb silty clay loam	30	48	135	low	good	low
21874	Bienville fine sand	45	18	73	fair	fair	good
21855	Bowie fine sandy loam	18	18	61	low	good	fair
21809	Cahaba fine sandy loam, deep phase	30	18	50	fair	fair	fair
21820	Crockett clay loam	6	18	84	low	good	good
21886	Greenville gravelly fine sandy loam	12	18	94	good	good	good
21872	Houston black clay	18	33	125	good	good	high
21862	Johnston clay	30	33	135	good	good	good
21890	Kalmia fine sand	30	13	26	low	low	low
21215	Kirvin fine sandy loam	18	13	50	low	low	low
21850	Kirvin fine sandy loam	12	18	50	good	good	low
11253	Kirvin fine sandy loam, probably	12	13	73	low	low	good
21807	Kirvin gravelly fine sandy loam	12	23	61	low	low	low
21812	Leaf fine sandy loam	30	18	61	fair	low	fair
21803	Lufkin fine sand	12	13	38	low	fair	fair
21217	Lufkin very fine sandy loam	12	18	73	low	low	fair
21783	Norfolk fine sand	45	13	61	low	low	fair
3379	Norfolk fine sand, probably	12	13	125	low	good	good
9271	Norfolk fine sand, probably	12	13	50	fair	low	fair
9809	Norfolk fine sand, probably	12	13	38	fair	fair	low
12959	Norfolk fine sand, probably	35	13	61	fair	fair	fair
21785	Norfolk fine sandy loam	12	8	61	low	low	good
21814	Norfolk fine sandy loam	18	13	50	fair	low	fair
4581	Norfolk fine sandy loam, probably	45	18	84	fair	low	fair

Table 5. Interpretation of analyses of surface soils of Henderson county—Continued

Laboratory number		Corn possibility two million pounds: Active phosphoric acid	Corn possibility two million pounds: Total nitrogen	Corn possibility two million pounds: Active potash	Total phosphoric acid	Acid-soluble potash	Acid-soluble lime
5098	Norfolk fine sandy loam, probably	24	18	....	low	low	fair
21224	Norfolk sand	18	8	26	low	low	fair
21876	Ochlockonee fine sand	45	18	61	good	fair	low
21870	Ochlockonee fine sandy loam	24	18	73	good	fair	good
21868	Ochlockonee silty clay loam	30	43	125	good	good	good
21805	Ochlockonee very fine sandy loam	18	28	84	good	good	good
21884	Orangeburg fine sandy loam	18	13	61	low	fair	low
21864	Peat	....	63	....	....	....	....
21866	Portsmouth fine sand	18	33	26	low	fair	low
21860	Ruston fine sand	18	13	61	low	low	low
21219	Ruston fine sandy loam	12	8	38	low	low	low
21880	Ruston fine sandy loam	12	13	50	low	fair	fair
21878	Sumter clay loam	12	33	154	fair	good	good
21888	Susquehanna fine sandy loam	18	18	61	low	low	low
13246	Susquehanna fine sandy loam, probably	6	13	38	low	fair	good
9302	Susquehanna fine sandy loam, probably	24	18	50	fair	low	fair
9179	Susquehanna fine sandy loam, probably	12	18	50	good	low	good
21853	Trinity fine sandy loam	45	48	125	low	good	fair
21818	Wilson clay	35	33	204	good	good	good
21858	Wilson fine sandy loam	12	23	50	low	fair	fair

Table 6. Pot experiments on soils of Henderson county.

Laboratory number	Type name	Weight crop in grams				Corn possibility of plant food withdrawn, in bushels		
		With complete fertilizer	Without phosphoric acid	Without nitrogen	Without potash	Phosphoric acid	Nitrogen	Potash
8840	Surface soil, corn	43.1	15.5	12.1		----	----	
"	Surface soil, sorghum	19.3	7.5	2.6		9	7	
8841	Subsoil to 8840, corn	25.7	7.2	7.4		10	9	
"	Subsoil to 8840, sorghum	36.7	8.0	0.4		8	7	
21783	Norfolk fine sand, surface, corn	41.8	39.0	9.0	39.5	65	13	191
"	Norfolk fine sand, surface, sorghum	23.5	19.4	8.0	17.0	58	19	88
21784	Norfolk fine sand, subsoil, corn	44.8	27.9	3.7	27.6	49	7	168
"	Norfolk fine sand, subsoil, sorghum	6.8	8.9	5.0	4.2	28	13	33
9271	Norfolk fine sand, probably, surface, corn		8.5					
"	Norfolk fine sand, probably, surface, sorghum		10.7					
9272	Norfolk fine sand, probably, subsoil, corn		6.2			7		
"	Norfolk fine sand, probably, subsoil, sorghum		2.7			2		
21785	Norfolk fine sandy loam, surface, corn	33.0	9.3	5.0	30.1	12	8	172
"	Norfolk fine sandy loam, surface, sorghum	10.1	7.8	2.5	8.9	13	9	76
21786	Norfolk fine sandy loam, subsoil, corn	27.5	2.9	6.4	22.7	3	9	281
"	Norfolk fine sandy loam, subsoil, sorghum	21.0	4.1	3.1	20.9	5	8	156
5098	Norfolk fine sandy loam, probably, surface corn	40.4	27.2	30.3	39.6	33	45	147
"	Norfolk fine sandy loam, probably, surface sorghum	25.9	22.7	5.9	20.6	22	15	82
5099	Norfolk fine sandy loam, probably, subsoil, corn	36.4			36.9			
"	Norfolk fine sandy loam, probably, subsoil, sorghum	21.8			12.5			
9179	Susquehanna fine sandy loam, probably, surface, corn	49.7		20.1			27	
"	Susquehanna fine sandy loam, probably, surface, sorghum	32.3		4.7			----	
9180	Susquehanna fine sandy loam, probably, subsoil, corn	35.5			29.9			108
"	Susquehanna fine sandy loam, probably, subsoil, sorghum	34.2			30.8			52
9302	Susquehanna fine sandy loam, probably, surface, corn	42.4		13.4			16	
"	Susquehanna fine sandy loam, probably, surface, sorghum	6.9		3.2			10	
9303	Susquehanna fine sandy loam, probably, subsoil, corn	38.4			27.9			66
"	Susquehanna fine sandy loam, probably, subsoil, sorghum	33.8			27.2			35

Light-brown or gray topsoil with yellow subsurface, with yellow very permeable subsoil—Kalmia soils.

Brown to grayish-brown topsoil with yellowish-brown or light-brown fine sandy friable subsoil—Bienville soils.

Light-brown topsoil with reddish or yellowish subsurface and dense mottled red and gray subsoils, very slowly permeable—Leaf soils.

Dark-gray or gray topsoil with light-gray or gray dense heavy subsoil very slowly permeable—Irving soils.

Black to dark-brown friable calcareous topsoil, dark-gray to brown subsoil—Bell soils (Black Prairie area).

Flat Stream Bottoms—East Texas Timber Country:

Black calcareous topsoil with heavy drab to black subsoil—Trinity soils.

Black non-calcareous topsoil with heavy gray to black non-calcareous subsoil—Johnson soils.

Grayish-brown to brown topsoil with grayish-brown to brown subsoil—Ochlockonee soils.

Gray or slightly mottled topsoil with gray to slightly mottled gray and brown subsoil—Bibb soils.

Upland Blackland Prairie Soils:

Black, dark-gray or ashy-black to brown calcareous friable topsoil with dark-gray, brown or yellowish, moderately friable subsoil—Houston soils.

Brown or yellowish-brown calcareous friable topsoil with crumbly yellow to greenish-yellow subsoil—Sumter soils.

Black to dark-gray topsoil very tight when dry, non-calcareous, with dense, tough brown or dark-gray subsoil—Wilson soils.

SOILS OF HIDALGO COUNTY

Hidalgo County is located in the extreme southern part of Texas in the geographical region known as the Rio Grande Plain. Twenty-nine soil types are mapped in 12 series. The Brennan fine sandy loam occupies 35.5 per cent, the Nueces fine sand 17.0 per cent, the Hidalgo fine sandy loam 10.5 per cent, and the Harlingen clay 9.5 per cent of the area. The dark-colored soils of the upland plain include the Victoria, Hidalgo, Tiocano, and Willacy series. The light-colored soils of the upland plain include the Brennan, Nueces, Delfina, and Duval series. The flat stream bottoms include the Harlingen, Laredo, Rio Grande, and Raymondville series.

Composition of Soils

Table 7 gives the analyses of the different soil types and Table 8 an interpretation of the results. The light-colored upland soils are somewhat low in nitrogen and phosphoric acid but are better supplied with

Table 7. Analyses of soils of Hidalgo county

Laboratory number		Nitrogen per cent	Total phos. ac. per cent	Active phos. ac per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH	Depth inches
23245	Brennan fine sandy loam	.051	.034	53	1.72	.36	504	.29	.58	6.9	0-7
23246	Brennan fine sandy loam	.055	.038	37	1.78	.51	566	.33	.68	7.9	7-19
23340	Brennan fine sandy loam	.030	.023	22	1.60	.39	358	.23	.50	7.2	7-19
2230	Brennan fine sandy loam, probably	.117	.045	72	1.34	.80	----	.50	1.02	--	0-11
2231	Brennan fine sandy loam, probably	.039	.035	69	----	.83	----	2.21	3.68	--	subsoil
23347	Brennan gravelly loam	.049	.058	164	1.21	----	131	----	8.38	7.6	0-7
23348	Brennan gravelly loam	.040	.069	21	.86	----	33	----	18.00	7.6	7-19
23349	Brennan loamy fine sand	.031	.029	49	1.63	.32	393	.32	.57	7.5	0-7
23350	Brennan loamy fine sand	.030	.029	57	1.55	.29	378	.31	.55	7.3	7-19
Average	Delfina fine sandy loam	.026	.024	26	.94	.22	228	.20	.45	7.2	surface
Average	Delfina fine sandy loam	.035	.027	42	1.07	.26	198	.22	.43	7.2	subsoil
Average	Duval fine sandy loam	.033	.024	16	1.43	.22	206	.16	.22	6.7	surface
Average	Duval fine sandy loam	.030	.022	14	1.41	.25	218	.13	.26	6.8	subsoil
23323	Harlingen clay	.167	.206	103	2.07	.92	685	14.41	25.54	8.2	0-7
23324	Harlingen clay	.108	.192	71	1.63	.78	316	15.69	28.50	7.7	7-19
23325	Harlingen clay, light-colored phase	.103	.170	41	2.02	.85	281	15.95	28.00	7.3	0-7
23326	Harlingen clay, light-colored phase	.070	.161	39	1.93	.82	226	16.65	30.60	7.5	7-19
23333	Hidalgo clay loam	.116	.068	76	.85	.86	1077	.83	1.55	7.3	0-7
23334	Hidalgo clay loam	.078	.078	46	1.54	.90	836	.60	1.30	7.3	7-19
23343	Hidalgo fine sandy clay loam	.098	.054	126	.85	.66	1026	.99	1.25	7.0	0-7
23344	Hidalgo fine sandy clay loam	.074	.042	67	1.03	.74	726	.75	1.23	7.2	7-19
23205	Hidalgo fine sandy loam	.084	.056	131	1.74	.58	670	.99	1.78	8.1	0-7
23206	Hidalgo fine sandy loam	.068	.063	168	1.62	.59	279	3.52	5.95	8.3	7-19
23335	Hidalgo fine sandy loam, light phase	.045	.040	40	.57	.33	476	.31	.58	7.3	0-7
23336	Hidalgo fine sandy loam, light phase	.046	.043	38	1.19	.38	595	.30	.60	7.3	7-19
23353	Hidalgo silty clay loam	.115	.127	531	2.18	.97	1070	4.91	9.00	7.3	0-7
23354	Hidalgo silty clay loam	.082	.095	132	2.08	1.00	688	6.77	16.60	7.3	7-19
3371	Laredo clay, probably	.159	.162	39	1.84	1.23	382	12.01	----	--	0-6
3372	Laredo clay, probably	.120	.122	43	1.90	1.16	272	14.83	----	--	6-16
23337	Laredo silty clay loam	.108	.211	196	1.05	.19	445	12.16	22.40	7.4	0-7
23338	Laredo silty clay loam	.079	.182	229	1.52	.56	273	12.78	22.60	7.5	7-19
23359	Nueces fine sand	.019	.025	14	.94	.11	128	.12	.47	7.1	0-7
23360	Nueces fine sand	.023	.018	19	.87	.12	137	.10	.30	7.0	7-19
23357	Rio Grande clay	.135	.168	66	1.66	.78	413	12.40	22.00	7.3	0-7
23358	Rio Grande clay	.081	.149	69	1.69	.72	309	11.66	21.30	7.6	7-19
23329	Rio Grande silty clay loam	.152	.169	65	2.18	.78	362	12.46	22.20	7.4	0-7
23330	Rio Grande silty clay loam	.179	.197	119	2.20	.78	478	12.95	22.60	7.4	7-19
23355	Rio Grande very fine sandy loam	.037	.098	48	1.69	----	132	----	15.30	7.6	0-7

Laboratory number		Nitrogen per cent	Total phos. ac. per cent	Active phos. ac per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH	Depth inches
23356	Rio Grande very fine sandy loam	.011	.068	128	2.16	----	111	-- ----	11.10	7.5	7-19
23345	Tiocano clay	.077	.043	36	1.93	----	552	-- ----	1.09	7.0	0-7
23346	Tiocano clay	.057	.033	31	1.19	----	555	-- ----	1.07	7.1	7-19
23327	Victoria clay loam	.152	.192	236	1.08	.94	463	8.93	16.20	7.5	0-7
23328	Victoria clay loam	.088	.104	169	1.54	.87	200	6.24	11.10	7.5	7-19
23341	Victoria fine sandy clay loam	.146	.110	222	2.30	.92	1089	1.14	2.15	7.2	0-7
23342	Victoria fine sandy clay loam	.091	.104	287	.90	.90	867	3.61	5.68	7.5	7-19
Average	Victoria fine sandy loam	.083	.058	102	1.95	.56	718	.64	1.12	7.9	surface
Average	Victoria fine sandy loam	.068	.063	67	1.58	.59	534	.80	1.42	7.9	subsoil

Table 8. Interpretation of analyses of surface soils of Hidalgo county

Laboratory number		Corn possibility two million pounds			Total phosphoric acid	Acid-soluble potash	Acid-soluble lime
		Active phosphoric acid	Total nitrogen	Active potash			
23245	Brennan fine sandy loam	30	18	211	good	good	good
2230	Brennan fine sandy loam, probably	35	33	----	good	good	good
23347	Brennan gravelly loam	45	18	73	good	good	high
23349	Brennan loamy fine sand	30	13	171	low	good	good
Average	Delfina fine sandy loam	18	13	115	low	good	fair
Average	Duval fine sandy loam	12	113	105	low	good	fair
23323	Harlingen clay	45	48	256	good	good	high
23325	Harlingen clay, light-colored phase	30	33	135	good	good	high
23333	Hidalgo clay loam	35	33	306	good	good	good
23343	Hidalgo fine sandy clay loam	45	28	306	good	good	good
23205	Hidalgo fine sandy loam	45	28	251	good	good	good
23335	Hidalgo fine sandy loam, light phase	24	18	204	good	good	good
23353	Hidalgo silty clay loam	55	33	306	good	good	high
3371	Laredo clay, probably	24	43	171	good	good	high
23337	Laredo silty clay loam	45	33	188	good	good	high
23359	Nueces fine sand	12	8	73	low	good	good
23357	Rio Grande clay	35	38	180	good	good	high
23329	Rio Grande silty clay loam	35	43	163	good	good	high
23355	Rio Grande very fine sandy loam	30	13	73	good	good	high
23345	Tiocano clay	24	23	226	good	good	good
23327	Victoria clay loam	50	43	196	good	good	high
23341	Victoria fine sandy clay loam	50	43	306	good	good	good
Average	Victoria fine sandy loam	45	28	262	good	good	good

Table 9. Pot experiments on soils of Hidalgo county.

Labora tory number	Type name	Weight crop in grams				Corn possibility of plant food withdrawn, in bushels		
		With complete fertilizer	Without phosphoric acid	Without nitrogen	Without potash	Phosphoric acid	Nitrogen	Potash
23246	Brennan fine sandy loam, subsoil, corn	66.3	38.8	11.7	56.2			
"	Brennan fine sandy loam, subsoil, kafir	31.0	21.9	2.2	32.3			
23323	Harlingen clay, surface, corn	65.4	54.3	28.3	71.0			
"	Harlingen clay, surface, kafir	9.5	5.9	9.4	29.2			
23205	Hidalgo fine sandy loam, surface, cotton	23.2	15.5	15.4	23.8			
23206	Hidalgo fine sandy loam, subsoil, corn	31.0	12.4	12.3	27.8			
"	Hidalgo fine sandy loam, subsoil, kafir	21.9	10.5	2.6	22.0			
7615	Victoria fine sandy loam, surface, corn	35.2		10.8			15	
"	Victoria fine sandy loam, surface, sorghum	11.5		7.0			1	
7616	Victoria fine sandy loam, subsoil, corn			13.5			18	
"	Victoria fine sandy loam, subsoil, sorghum			2.9			7	
23321	Victoria fine sandy loam, surface, cotton	24.8	20.1	17.5				
23322	Victoria fine sandy loam, subsoil, cotton	24.4	20.4	22.7	21.8			

potash. The dark-colored upland soils and the bottom lands are well supplied with nitrogen and with phosphoric acid and are especially high in potash. The soils are all limestone soils, are not acid, and do not need lime. The light-colored soils are likely to need phosphoric acid and nitrogen under cultivation if supplied with sufficient water to enable the plant food to be utilized.

Pot experiments are given in Table 9. It is noted that some of the soils respond to applications of nitrogen and phosphoric acid or both.

Fertilizers

The soils of this section which are under irrigation are heavily cropped and many acres of them are planted in fruit or vegetable crops. Although many of them are well supplied with plant food, under this system of cropping they are likely to need applications of fertilizer within a short time, especially for the fruit and vegetable crops. Phosphoric acid and nitrogen are needed to a greater extent than potash, of which there appears a very good supply in most of the soils. The soils contain an abundance of lime and do not need liming.

Salty Soils

Soils which contain the sufficient amount of soluble salts to injure or entirely destroy some crops occur in spots in the areas of salty soils. They are likely to increase on irrigated soils where there is not proper underdrainage. When the ground water is found near enough to the surface to evaporate constantly it will rise and evaporate, thereby leaving any soluble salts it contains and causing them constantly to accumulate. When the irrigation water is applied and the soil does not permit some of the water to pass through and out into the drainage water, salt will accumulate even where the quantity of irrigation water is small. The only way to prevent the accumulation of the salts is to wash them out through the subsoil by means of sufficient applications of irrigation water. This process may not be possible on a soil with a heavy impervious subsoil or where the subsoil water cannot drain off but is forced to accumulate. A rise of ground water within 4 to 5 feet of the surface may be regarded as a sign of danger, as such a rise is likely to be followed by an accumulation of salts in the soil.

Classification of Soils of Hidalgo County

Dark-colored Soils of Upland Plains:

Black to very dark-brown or dark grayish-brown, calcareous, friable topsoil with dark-gray, brown, or yellowish crumbly subsoil—Victoria soils.

Brown calcareous friable topsoil with brown or yellowish crumbly calcareous subsoil—Hidalgo soils.

Brown friable, non-calcareous topsoil with brown or yellowish, crumbly subsoil—Willacy soils.

Ashy-gray to black top and subsoil, with tough consistence and heavy texture poorly drained—Tiocano series.

Light-colored Soils of Upland Plains:

Very light grayish-brown or gray, friable, non-calcareous topsoil with yellow crumbly non-calcareous subsoil—Brennan soils.

Gray, friable, non-calcareous topsoil with gray or yellowish friable non-calcareous subsoil—Nueces soils.

Red or reddish-brown friable non-calcareous topsoil with a similar subsoil—Duval soils.

Brown or reddish-brown sandy topsoils with tough heavy gray or yellow almost impervious subsoil—Delfina soils.

Flat Stream Bottoms, Subject to Overflow:

Light-brown to gray calcareous friable topsoil with gray to light-brown or yellowish calcareous crumbly subsoil—Rio Grande soils.

Brown calcareous friable topsoil with brown or yellow calcareous friable crumbly subsoil—Laredo soils.

Dark gray to dark-brown calcareous heavy topsoil with dark-gray or brown dense calcareous subsoil—Harlingen soils.

Gray to brownish-gray calcareous topsoil with light-gray, ash-brown, or yellowish calcareous subsoil with poor natural drainage—Raymondville soils.

SOILS OF MILAM COUNTY

Milam County is in east-central Texas, partly in the East Texas Timber Country and partly in the Blackland Prairie. Thirty types of soil were mapped in 18 series. The most extensive type is the Houston black clay occupying 11.7 per cent of the area, followed by Catalpa clay with 10.0, Kirvin fine sandy loam with 9.9, Norfolk fine sand with 9.8, Luverne fine sandy loam with 9.9, Bell clay with 5.6, and Susquehanna fine sandy loam with 5.5 per cent of the area. The soils of the East Texas Timber Country in the eastern part of the county include the Kirvin, Norfolk, and Luverne series, which are timbered uplands with friable subsoils and the Tabor and Susquehanna series, which are timbered uplands with heavy subsoils. The East Texas bottom lands include the Ochlockonee and Miller series. The Blackland Prairie soils include the Houston, Wilson, and Crockett series. The terrace soils of the Black Prairie include the Louisville, Bell, Milam, and Irving series while the bottom soils of the Black Prairie include the Trinity, Catalpa, and Yahola series.

Composition of Soils

Table 10 gives the composition of the various soils types and Table 11 the interpretation of the analyses. The soils of the Blackland Prairie section are better supplied with plant food than those of the East Texas Timber Country. The upland soils of the East Texas Timber Country are somewhat low in nitrogen and phosphoric acid but are better supplied with potash. The soils of this country, in general, are practically neutral and some of them are basic, being limestone soils.

Pot experiments on some of these soils are given in Table 12. It is noted that some of these soils respond to applications of nitrogen and phosphoric acid while few of them respond in crop yields to potash.

Fertilizers

The soils of the eastern part of the county are likely to need fertilizers, especially nitrogen and phosphoric acid. Potash is less likely to be needed for field crops but is probably needed for some of the truck crops. No need for an application of lime is indicated at the present time, although some of these East Texas soils will probably become acid on further cultivation. The soils of the Blackland Prairie are less in need of fertilizers than those of the East Texas region and most of them are hardly likely to need lime, on account of their highly calcareous nature.

Classification of Soils of Milam County

Upland Soils of East Texas Timber Country:

Light-brown to grayish or slightly reddish, topsoil with red slowly permeable subsoil—Kirvin soils.

Gray topsoil with yellow sub-surface and yellow very permeable and sandy subsoil—Norfolk soils.

Gray friable or grayish-brown topsoil with heavy red crumbly subsoil—Luverne soils.

Light-brown to gray topsoil with yellow subsurface and red to yellow dense moderately permeable subsoil—Tabor soils.

Light-brown to gray topsoil with yellow subsurface and red and gray mottled dense subsoil slowly permeable—Susquehanna soils.

Flat Stream Bottoms, Subject to Overflow:

Light-brown or grayish topsoil with brown or yellow or mottled subsoil—Ochlockonee soils.

Red calcareous, friable topsoil with red calcareous crumbly subsoil—Miller soils.

Upland Blackland Prairie Soils:

Black dark-gray or ashy-black to brown friable topsoil, calcareous, with dark-brown or yellowish calcareous crumbly subsoil—Houston soils.

Black to dark-gray non-calcareous topsoil with brown or dark-gray dense tough subsoil—Wilson soils.

Black to brown or spotted moderately friable topsoil with reddish or yellowish or mottled with gray subsoil—Crockett soils.

Table 10. Analyses of soils of Milam county

Laboratory number		Nitrogen per cent	Total phos. ac. per cent	Active phos. ac. per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH	Depth inches
Average	Bell clay	.091	.067	131	.82	.33	327	2.87	5.02	7.2	surface
Average	Bell clay	.070	.047	80	.74	.32	206	3.62	7.06	7.4	subsoil
Average	Catalpa clay	.110	.111	40	1.13	—	254	—	23.20	7.3	surface
Average	Catalpa clay	.089	.104	43	1.06	.84	187	7.82	23.97	7.4	subsoil
Average	Catalpa clay	.060	.091	85	1.23	.56	146	4.70	20.39	7.6	deep subsoil
23696	Crockett clay loam	.132	.054	15	1.40	—	398	—	1.18	6.7	0-7
23697	Crockett clay loam	.087	.051	12	1.52	—	244	—	1.55	6.5	7-19
Average	Crockett fine sandy loam	.072	.035	18	.72	.21	142	.30	.78	6.5	surface
Average	Crockett fine sandy loam	.059	.030	11	.66	.30	136	.56	1.23	7.1	subsoil
Average	Houston black clay	.116	.064	139	.91	.47	529	2.33	3.41	7.2	surface
Average	Houston black clay	.082	.044	66	.64	.49	356	2.97	3.86	7.1	subsoil
Average	Houston clay	.123	.112	148	1.52	.85	366	6.54	6.71	7.3	surface
Average	Houston clay	.075	.112	257	1.43	.80	213	7.66	8.07	7.5	subsoil
23672	Houston clay loam	.163	.044	31	.42	.19	185	2.89	4.45	7.2	0-7
23673	Houston clay loam	.080	.031	13	.65	.17	109	5.87	8.58	7.6	7-19
23678	Irving clay loam	.072	.045	48	1.13	—	306	—	1.68	6.8	0-7
23679	Irving clay loam	.043	.029	27	—	—	205	—	1.63	7.1	7-19
Average	Kirvin fine sandy loam	.045	.033	14	1.05	.10	146	.21	.43	6.4	surface
Average	Kirvin fine sandy loam	.052	.031	8	1.01	.34	129	.48	1.04	6.5	subsoil
Average	Lewisville clay, probably	.142	.025	288	—	.16	190	.32	.44	6.2	surface
Average	Lewisville clay, probably	.072	.076	113	—	.31	565	.38	.85	6.8	subsoil
Average	Luverne fine sandy loam	.030	.027	23	.88	.07	105	.13	.32	6.4	surface
Average	Luverne fine sandy loam	.045	.027	11	.76	.23	143	.16	.45	6.2	subsoil
Average	Milam fine sandy loam	.017	.028	32	.33	.05	102	.12	.20	6.9	surface
Average	Milam fine sandy loam	.027	.036	22	.39	.15	115	.15	.35		subsoil
Average	Miller clay	.081	.118	104	1.85	.87	189	9.94	14.25	7.4	surface
Average	Miller clay	.087	.121	95	1.58	.94	331	8.70	13.55	7.5	subsoil
Average	Miller clay	.063	.102	33	1.71	.92	166	8.45	15.20	7.6	deep subsoil
Average	Norfolk fine sand	.033	.027	23	.62	.09	82	.13	.22	6.5	surface
Average	Norfolk fine sand	.016	.018	14	.64	.07	74	.09	.13	6.8	subsoil
Average	Susquehanna fine sandy loam	.043	.028	18	1.58	.10	125	.12	.30	6.8	surface
Average	Susquehanna fine sandy loam	.035	.022	10	1.56	.30	123	.16	.49	6.1	subsoil
23682	Tabor fine sandy loam	.042	.023	15	.58	.10	98	.18	.23	6.5	0-7
23683	Tabor fine sandy loam	.020	.018	9	.80	.14	68	.11	.25	6.4	7-19
Average	Wilson clay loam	.085	.041	60	.68	—	261	—	1.37	6.8	surface
Average	Wilson clay loam	.062	.033	28	—	—	193	—	1.40	6.7	subsoil
Average	Wilson fine sandy loam	.059	.044	46	.56	.10	138	.16	.54	6.5	surface
Average	Wilson fine sandy loam	.054	.032	16	.68	.23	129	.50	1.06	6.6	subsoil
22787	Yahola clay	.125	.142	177	2.31	.95	459	7.68	13.70	7.2	0-7
22788	Yahola clay	.057	.097	63	1.83	.77	161	7.76	13.80	7.4	7-19
22789	Yahola clay	.048	.083	133	1.86	.66	142	6.77	12.00	7.3	19-60

Table 11. Interpretation of analyses of surface soils of Milam county

Laboratory number		Corn possibility two million pounds			Total phosphoric acid	Acid-soluble potash	Acid-soluble lime
		Active phosphoric acid	Total nitrogen	Active potash			
Average	Bell clay	45	28	154	good	good	high
Average	Catalpa clay	24	33	125	good	good	high
23696	Crockett clay loam	12	38	171	good	good	fair
Average	Crockett fine sandy loam	12	23	73	good	good	good
Average	Houston black clay	45	33	219	good	good	high
Average	Houston clay	45	38	163	good	good	high
23672	Houston clay loam	24	48	94	good	good	high
23678	Irving clay loam	30	23	144	low	—	good
Average	Kirvin fine sandy loam	12	18	73	good	low	good
Average	Lewisville clay, probably	50	43	94	low	fair	good
Average	Luverne fine sandy loam	18	13	61	low	low	fair
Average	Milam fine sandy loam	24	8	61	low	low	fair
Average	Miller clay	45	28	94	good	good	high
Average	Norfolk fine sand	18	13	50	low	fair	good
Average	Susquehanna fine sandy loam	12	18	61	low	low	fair
23682	Tabor fine sandy loam	12	18	50	low	low	fair
Average	Wilson clay loam	30	28	125	good	fair	good
Average	Wilson fine sandy loam	30	18	73	fair	low	fair
22787	Yahola clay	45	38	196	good	good	high

Table 12. Pot experiments on soils of Milam county

Laboratory number	Type name	Weight crop in grams: With complete fertilizer	Without phosphoric acid	Without nitrogen	Without potash	Corn possibility of plant food withdrawn, in bushels: Phosphoric acid	Nitrogen	Potash
23961	Bell clay, subsoil, corn	18.2	9.8	9.6	9.6	16	25	202
"	Bell clay, subsoil, kafir	22.5	20.0	4.6	27.7	19	10	268
7104	Bell clay, probably, surface, corn	46.4		23.0			29	
"	Bell clay, probably, surface, sorghum	30.5		4.5			9	
7105	Bell clay, probably, subsoil, corn	37.7		22.4			28	
"	Bell clay, probably, subsoil, sorghum	29.3		3.4			7	
23950	Catalpa clay, surface, corn	50.4	49.2	34.5	41.6	94	53	714
"	Catalpa clay, surface, kafir	23.5	8.5	5.0	26.2	29	15	284
"	Catalpa clay, surface, cotton	28.2	30.5			93		
23951	Catalpa clay, subsoil, corn	44.5	49.4	37.5	43.7	92	52	622
"	Catalpa clay, subsoil, kafir	28.2	28.4	4.8	27.2	50	11	236
"	Catalpa clay, subsoil, cotton	31.2	29.4			63		
23972	Catalpa clay, surface, corn	32.0	30.0	24.5	38.5			
"	Catalpa clay, surface, kafir	20.2	21.6	4.3	23.0			
23973	Catalpa clay, subsoil, corn	16.8	16.0	14.5	17.6	29	34	426
"	Catalpa clay, subsoil, kafir	24.1	21.6	5.6	25.9	27	11	313
23952	Houston clay, surface, corn	11.4	7.3	10.8	16.8	12	40	292
"	Houston clay, surface, kafir	7.5	6.5	5.4	5.6	16	27	59
"	Houston clay, surface, cotton	16.8	13.4			32		
23953	Houston clay, subsoil, corn	16.0	6.1	12.7	18.0	8	34	269
"	Houston clay, subsoil, kafir	17.9	8.3	3.1	21.1	19	8	164
"	Houston clay, subsoil, cotton	11.5	6.0			9		
23956	Houston black clay, surface, corn	26.8	22.3	16.8	26.8	38	29	578
"	Houston black clay, surface, kafir	26.8	24.6	5.8	28.3	35	15	385
"	Houston black clay, surface, cotton	24.5	21.7			57		
23957	Houston black clay, subsoil, corn	16.1	9.9	11.9	12.8	13	22	
"	Houston black clay, subsoil, kafir	31.4	26.6	4.7	38.8	22	10	409
23970	Houston black clay, gravelly phase, surface, corn	58.5	59.1	49.3	54.5			
"	Houston black clay, gravelly phase, surface kafir	19.7	21.9	16.0	35.0			
23971	Houston black clay, gravelly phase, subsoil, corn	58.2	49.8	41.5				
"	Houston black clay, gravelly phase, subsoil, kafir	3.0	5.1	5.2				
23964	Kirvin fine sandy loam, surface, cotton		16.9			20		
23965	Kirvin fine sandy loam, subsoil, cotton		2.6			4		

Table 12. Pot experiments on soils of Milam county—Continued

Laboratory number	Type name	Weight crop in grams				Corn possibility of plant food withdrawn, in bushels		
		With complete fertilizer	Without phosphoric acid	Without nitrogen	Without potash	Phosphoric acid	Nitrogen	Potash
7120	Lewisville clay, probably, surface, corn	39.7	11.5			13		
"	Lewisville clay, probably, surface, sorghum	33.3	16.6			23		
23949	Luverne fine sandy loam, subsoil, corn		4.5	20.0		4	27	
"	Luverne fine sandy loam, subsoil, kafir		4.7	3.2		4	7	
"	Luverne fine sandy loam, subsoil, cotton		2.0	14.0		6	70	
23946	Miller clay, surface, corn	28.5	25.8	19.0	30.0	46	32	654
"	Miller clay, surface, kafir	49.5	42.0	6.8	45.6	67	13	536
23947	Miller clay, subsoil, corn	21.0	13.3	13.6	24.1	18	24	478
"	Miller clay, subsoil, kafir	37.1	24.4	7.1	39.8	19	11	387
23963	Norfolk fine sand, subsoil, cotton		3.4			3		
23968	Susquehanna fine sandy loam, surface, corn		7.4	10.3		18	15	
"	Susquehanna fine sandy loam, surface, kafir		18.9	3.9		19	10	
"	Susquehanna fine sandy loam, surface, cotton		14.7	8.0		17	65	
23969	Susquehanna fine sand, probably, subsoil corn		6.5	11.5	26.5	8	112	183
"	Susquehanna fine sand, probably subsoil, kafir		7.2	3.2	21.7	7	7	97
"	Susquehanna fine sand, probably subsoil, cotton		3.5	7.7		32	20	

Flat Stream Bottoms, Blackland Prairie Region Subject to Overflow:

Black to dark-brown friable permeable calcareous soils with black or dark-gray heavy permeable subsoil—Trinity soils.

Brown friable, permeable calcareous topsoil with brown or grayish friable permeable subsoil—Catalpa soils.

Red friable calcareous topsoil with red calcareous subsoil lighter in texture than topsoil—Yahola soils.

Blackland Prairie—Flat to Undulating Old Stream Benches Subject to Overflow:

Brown or reddish-brown topsoil with heavy reddish clay subsoil not calcareous—Milam soils.

Black to dark-brown friable topsoil with dark-gray to brown crumbly subsoil—Bell soils.

Brown friable calcareous topsoil with brown or yellow crumbly subsoil—Lewisville soils.

Dark-ashy-gray to black tight topsoil with dark gray to brown dense tough subsoil not calcareous—Irving soils.

Soils of Nacogdoches County

Nacogdoches County is in the east-central part of Texas and is located entirely in the East Texas Timber Country. Twenty-eight soil types belonging to 17 series have been mapped in this county. The timbered uplands with friable subsoils include the Norfolk, Ruston, Nacogdoches, Bowie, Orangeburg, Kirvin, and Willacy series. The timbered uplands with dense subsoils include the Lufkin, Susquehanna, and Tabor series. The old terrace soils with friable subsoils include the Kalmia and Cahaba series, while those with dense subsoils include the Leaf, Myatt, and Sumter series. The flat stream bottoms carry soils of the Hannahatchee, Bibb, and Ochlockonee series. The most extensive soil type is the Ruston fine sandy loam occupying 22.9 per cent of the area, followed by the Kirvin fine sandy loam on 20.6 per cent of the area. The Norfolk fine sand occupies 10.4 per cent and the Ochlockonee fine sandy loam 5.3 per cent of the area.

Composition of Soils

Table 13 gives the analyses of the different soil types and Table 14 an interpretation of the analyses. The soils of the county are in general low in nitrogen, in active phosphoric acid, and somewhat better supplied with potash. They are nearly neutral in reaction, although a few are acid, one of which is the Bibb clay loam. The soils are likely to need nitrogen, phosphoric acid, and probably potash. For legume crops lime is also likely to be needed. Pot experiments on some of the soils are given in Table 15. In general, the pot experiments confirm the conclusions from the chemical analysis, especially the need of the nitrogen and phosphoric acid.

Fertilizers

Fertilizers carrying phosphoric acid, nitrogen, and potash are generally needed on these soils for crops of all kinds. The soils of this county seem to be particularly in need of phosphoric acid. This conclusion from the chemical analyses is confirmed by field experiments (See Bulletin 469).

Classification of Soils of Nacogdoches County

Timbered Uplands with Friable Subsoils:

Gray topsoil with yellow subsurface, gray and yellow, very permeable, and sandy subsoil—Norfolk soils.

Light-brown to grayish topsoil with brown, yellowish, or reddish subsurface, reddish-yellow, reddish-brown or light-red, very permeable subsoil—Ruston soils.

Red topsoil containing ironstone fragments, red, slowly permeable subsoil—Nacogdoches soils.

Gray to light-brown topsoil, yellow subsurface, yellow mottled with gray and red permeable subsoil—Bowie soils.

Light-brown to grayish or slightly reddish topsoil, red with some gray mottled, slowly permeable subsoil—Kirvin soils.

Yellowish-gray fine sandy topsoil with friable sandy clay, red subsoil—Orangeburg soils.

Red fine sandy topsoil with red friable permeable sandy clay subsoil—Greenville soils.

Black to dark-gray topsoils with dense, tough dark-gray clay or brown subsoil—Wilson soils.

Timbered Uplands with Dense Subsoil:

Light-brown to gray topsoil with yellow subsurface and red and gray mottled dense very slowly permeable subsoil—Susquehanna soils.

Gray, tight on drying, topsoil with gray dense very slowly permeable subsoil—Lufkin soils.

Light-brown to gray topsoil with yellow subsurface and yellow subsoil with gray mottlings rather dense but moderately permeable—Tabor soils.

Brown or yellowish-brown calcareous topsoil undulating with yellow or olive-colored calcareous gray subsoil—Sumter soils.

Old Stream Benches Above Overflow:

Light-brown topsoil, reddish or yellowish subsurface with light-red subsoil very permeable—Cahaba soils.

Light-brown or gray topsoil with yellow subsurface and yellow very permeable subsoil—Kalmia soils.

Light-brown topsoil, reddish or yellowish subsurface, dense mottled red and gray very slowly permeable subsoil—Leaf soils.

Gray topsoil, gray dense subsoil, very slowly permeable—Myatt soils.

Table 13. Analyses of soils of Nacogdoches County

Laboratory number		Nitrogen per cent	Total phos. ac. per cent	Active phos. ac. per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH	Depth inches
24029	Bibb clay loam	.119	.138	13	1.14	.41	152	.15	.55	5.2	0-7
24030	Bibb clay loam	.173	.158	15	1.39	.36	147	.26	.65	5.0	7-19
22280	Bowie fine sandy loam	.036	.031	35	.72	.07	210	.11	.08	7.0	0-6
22281	Bowie fine sandy loam	.019	.014	10	.85	.06	115	.07	.05	7.4	6-15
22282	Bowie fine sandy loam	.022	.013	6	.54	.17	105	.12	.25	6.0	15-36
24043	Cahaba fine sandy loam	.025	.024	30	.40	.06	84	.07	.25	6.5	0-7
24044	Cahaba fine sandy loam	.028	.025	8	.45	.20	139	.17	.40	6.7	7-19
Average	Greenville fine sandy loam, probably	.048	.082	20	.59	.12	172	.11	.38	6.5	surface
Average	Greenville fine sandy loam, probably	.045	.118	14	.76	.16	105	.11	.44	6.3	subsoil
Average	Kirvin clay loam	.100	.109	11	.46	.20	257	.11	.84	6.6	surface
Average	Kirvin clay loam	.064	.100	9	.37	.35	158	.20	.98	6.3	subsoil
Average	Kirvin fine sandy loam	.066	.057	30	.42	.14	166	.13	.39	6.5	surface
Average	Kirvin fine sandy loam	.037	.049	8	.81	.60	188	.46	.55	6.2	subsoil
Average	Kirvin fine sandy loam	.029	.057	9	1.35	.63	258	.98	1.75	6.7	deep subsoil
993	Nacogdoches clay loam	.045	.052	16	.52	.22	----	.11	.24	--	0-12
22283	Nacogdoches gravelly clay loam	.067	.123	9	.72	----	246	----	.35	7.3	0-3
22284	Nacogdoches gravelly clay loam	.055	.109	8	.75	----	216	----	.50	6.2	3-36
22285	Nacogdoches gravelly fine sandy loam	.035	.043	4	.50	----	131	----	.15	7.1	0-10
22286	Nacogdoches gravelly fine sandy loam	.040	.052	9	.47	----	90	----	.40	5.4	10-36
Average	Norfolk fine sand	.036	.026	61	.36	.04	70	.08	.16	6.1	surface
Average	Norfolk fine sand	.016	.018	33	.37	.04	59	.06	.10	6.4	subsoil
Average	Norfolk fine sand	.013	.013	12	.28	.03	61	.02	.08	6.2	deep subsoil
Average	Norfolk fine sandy loam	.055	.028	20	.50	.07	86	.08	.19	6.1	surface
Average	Norfolk fine sandy loam	.019	.018	10	.31	.06	101	.04	.13	6.6	subsoil
Average	Norfolk fine sandy loam	.028	.016	9	.37	.18	133	.10	.22	5.9	deep subsoil
Average	Ochlockonee fine sandy loam	.060	.054	21	.32	.13	180	.24	.45	6.5	surface
Average	Ochlockonee fine sandy loam	.063	.059	8	.62	.16	108	.10	.38	6.6	subsoil
22287	Ochlockonee silty clay	.133	.205	14	.92	.61	261	.51	1.30	6.6	0-15
22288	Ochlockonee silty clay	.077	.135	4	1.15	.65	161	.41	1.30	6.4	15-36
24039	Ochlockonee silt loam	.101	.101	8	.31	.22	192	.18	.68	6.5	0-7
24040	Ochlockonee silt loam	.098	.096	8	1.01	.21	118	.25	.88	6.4	7-19
Average	Orangeburg fine sandy loam	.033	.043	30	.70	----	153	----	.19	6.8	surface
Average	Orangeburg fine sandy loam	.033	.041	6	.84	----	167	----	.29	6.2	subsoil
Average	Orangeburg fine sandy loam	.035	.044	4	----	----	152	----	.25	5.9	deep subsoil

Laboratory number		Nitroge per cen	Total phos. ac per cen	Active phos. ac per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cen	Basicity per cen	pH	Depth inches
32730	Orangeburg & Ruston fine sandy loam	.024	.032	17	----	----	149	----	.15	7.0	0-6
32733	Orangeburg & Ruston fine sandy loam	.032	.038	6	----	----	141	----	.29	5.8	16
32738	Orangeburg & Ruston fine sandy loam	.036	.043	4	----	----	131	----	.20	6.2	24
22121	Orangeburg sandy loam	.030	.033	22	.21	----	82	----	.10	6.6	surface
22122	Orangeburg sandy loam	.048	.062	11	.44	----	159	----	.30	6.0	subsoil
22289	Ruston fine sand	.026	.042	28	.55	.05	77	.08	.05	6.4	0-15
22290	Ruston fine sand	.013	.053	35	.48	.04	83	.04	.08	6.8	15-36
Average	Ruston fine sandy loam	.026	.028	9	.30	.05	49	.07	.29	6.4	surface
Average	Ruston fine sandy loam	.027	.033	7	.26	.19	49	.11	.30	6.5	subsoil
35708	Ruston surface soil	.037	----	17	----	----	148	----	.09	--	0-7
35709	Ruston subsoil	.033	----	4	----	----	121	----	.09	--	7-19

Table 14. Interpretation of analyses of surface soils of Nacogdoches county

Laboratory number		Corn possibility two million pounds			Total phosphoric acid	Acid-soluble potash	Acid-soluble lime
		Active phosphoric acid	Total nitrogen	Active potash			
24029	Bibb clay loam	12	33	84	good	good	fair
22280	Bowie fine sandy loam	24	13	105	fair	low	fair
24043	Cahaba fine sandy loam	18	13	50	low	low	low
Average	Greenville fine sandy loam, probably	12	18	84	fair	fair	fair
Average	Kirvin clay loam	12	28	125	good	good	fair
Average	Kirvin fine sandy loam	18	23	84	fair	fair	fair
993	Nacogdoches clay loam	12	18	----	fair	good	fair
22283	Nacogdoches gravelly clay loam	6	23	115	good	fair	fair
22285	Nacogdoches gravelly fine sandy loam	12	13	73	fair	fair	low
Average	Norfolk fine sand	35	13	38	low	low	fair
Average	Norfolk fine sandy loam	12	18	50	low	low	low
Average	Ochlockonee fine sandy loam	18	18	94	good	fair	good
22287	Ochlockonee silty clay	12	38	125	good	good	good
24039	Ochlockonee silt loam	6	33	94	good	good	fair
Average	Orangeburg fine sandy loam	18	13	84	fair	fair	fair
32730	Orangeburg & Ruston fine sandy loam	12	13	73	fair	fair	low
22121	Orangeburg sandy loam	18	13	50	fair	fair	low
22289	Ruston fine sand	18	13	50	fair	low	fair
Average	Ruston fine sandy loam	6	13	26	low	low	low
35708	Ruston surface soil	12	13	73	------	------	------

Table 15. Pot experiments on soils of Nacogdoches county

Labora-tory number	Type name	Weight crop in grams				Corn possibility of plant food withdrawn, in bushels		
		With complete fertilizer	Without phosphoric acid	Without nitrogen	Without potash	Phosphoric acid	Nitrogen	Potash
22901	Greenville fine sandy loam, probably, surface, corn	31.7	19.2	24.7		36	58	
”	Greenville fine sandy loam, probably, surface, kafir	36.0	28.7	8.7		41	14	
22906	Greenville fine sandy loam, probably, subsoil, corn	22.0	9.5	13.0	16.7	16	34	162
”	Greenville fine sandy loam, probably, subsoil, kafir	43.0	12.6	4.9	32.6	17	10	111
24005	Kirvin clay loam, surface, corn		4.9	9.7	11.2	7	56	254
”	Kirvin clay loam, surface, kafir		16.3	29.4	38.3	14	46	375
24006	Kirvin clay loam, subsoil, corn	2.7	2.3	2.7	6.6	3	14	86
”	Kirvin clay loam, subsoil, kafir	1.1	1.0	2.7	3.2	1	11	28
24007	Kirvin fine sandy loam, surface, corn		7.5	8.7	10.7	10	14	138
”	Kirvin fine sandy loam, surface, kafir		14.7	6.1	34.4	16	14	142
24008	Kirvin fine sandy loam, subsoil, cotton	16.0	8.5	9.2	14.2	11	31	125
24012	Kirvin fine sandy loam, subsoil, cotton	5.2	4.7	5.5		7	18	
23549	Norfolk fine sand, surface, cotton	14.7	11.5			37		
23550	Norfolk fine sand, subsoil, cotton	10.2	4.5	2.5		9		
76	Norfolk fine sandy loam, probably, surface, corn	9.2	4.7					
894	Norfolk fine sandy loam, surface, corn	49.9	34.6			38		
”	Norfolk fine sandy loam, surface, sorghum	17.4	16.8			30		
23551	Norfolk fine sandy loam, surface, cotton	19.6	10.4	13.4		17	43	
23552	Norfolk fine sandy loam, surface, cotton	17.7	4.5	5.8		8	16	
24003	Ochlockonee fine sandy loam, surface, corn	17.3	13.6	25.2		22	51	
”	Ochlockonee fine sandy loam, surface, kafir	25.7	14.9	5.3		23	15	
22121	Orangeburg sandy loam, surface, corn	30.0	13.7	15.4	32.4	24	26	232
”	Orangeburg sandy loam, surface, sorghum	17.7	24.1	5.2	16.5	37	13	110
22122	Orangeburg sandy loam, subsoil, corn	24.2	3.8	14.2	19.6	5	28	258
”	Orangeburg sandy loam, subsoil, sorghum	15.5	5.0	3.7	12.4	7	11	96
24009	Ruston fine sandy loam, surface, corn		4.6	3.5	13.0	5	7	27
”	Ruston fine sandy loam, surface, kafir		3.6	3.5	9.1	2	7	13
24010	Ruston fine sandy loam, subsoil, cotton	18.5	7.0	7.5		8	18	

Flat Stream Bottoms, Subject to Overflow:

Light-brown or grayish topsoil with brown or yellow or mottled subsoil—Ochlockonee soils.

Gray or slightly mottled topsoil with gray or slightly mottled gray and brown subsoil—Bibb soils.

Red or brown topsoil with red subsoil—Hannahatchie soils.

SOILS OF NAVARRO COUNTY

Navarro county is in east-central Texas and is located partly in the East Texas Timber Country and partly in the Blackland Prairie. Twenty-two soil types belonging to 16 soil series have been mapped in this county. The upland calcareous soils of the Blackland Prairie are classed as the Houston and Sumter soils. The non-calcareous upland soils are mapped as the Milam, Wilson, Ellis, and Crockett soils. The calcareous flat stream benches are mapped as Lewisville and Bell soils. The flat stream benches of the non-calcareous group are mapped as the Irving series. The calcareous stream bottoms are mapped as the Trinity and Catalpa series. The timbered upland soils of the East Texas Timber Country are mapped as the Susquehanna, Tabor, Myatt, and Oktibbeha series. The Wilson clay loam is the most extensive soil, occupying 17 per cent of the area, while Wilson fine sandy loam is practically as extensive, covering 16.9 per cent of the area. The Houston clay occupies 12 per cent, the Catalpa clay 11.2 per cent, the Trinity clay 6.4 per cent, and the Crockett fine sandy loam 5.9 per cent of the area.

Composition of Soils

Table 16 gives the analyses of the different soil types and Table 17 the interpretation of the analyses. The soils of the Blackland Prairie region are well supplied with plant food, their phosphoric acid, potash, and nitrogen content are good, and they are also well supplied with lime. The soils of the East Texas Timber Country are not so well supplied with plant food, especially nitrogen and phosphoric acid. They are somewhat better supplied with potash but are still inclined to be low. Nitrogen and phosphoric acid are both of importance in these soils.

Pot Experiments

Pot experiments are given in Table 18. Decided increases in growth are shown with both nitrogen and phosphoric acid with the Crockett fine sandy loam, Irving clay, Willacy clay loam, and Willacy fine sandy loam. The Houston black clay gave little increase with phosphoric acid but a decided increase with nitrogen.

Fertilizers

The use of fertilizers supplying nitrogen, phosphoric acid, and probably potash is indicated on the soils of the East Texas Timber Country. Some of the soils of the Black Prairie will also probably respond to phosphoric acid and nitrogen.

The soils of this section, in general are not acid and do not need lime. There are, however, some individual soils which are likely to become acid and these may eventually need lime, especially for legume crops. The sample of Myatt silty clay loam is somewhat acid.

Description of Soils of Navarro County

Upland Calcareous Soils of the Blackland Prairie:

Black, dark-gray or ashy-black to brown, friable topsoil with dark-gray, brown, or yellowish, moderately friable, subsoil—Houston soils.

Brown or yellowish-brown friable topsoil with yellow to greenish-yellow crumbly subsoil—Sumter soils.

Non-Calcareous Upland Soils:

Black to dark-gray topsoil, tight when dry, brown or dark-gray, dense tough subsoil—Wilson soils.

Brown, moderately friable topsoil with greenish-yellow dense subsoil —Ellis soils.

Black to brown or spotted, moderately friable reddish or yellowish or mottled with gray subsoil—Crockett soils.

Flat Stream Benches above Overflow:

Black to dark-brown friable topsoil with dark-gray to brown crumbly subsoil—Bell soils.

Brown friable topsoil with brown or yellow crumbly subsoil—Lewisville soils.

Non-calcareous Stream Benches above Overflow:

Dark ashy-gray to black topsoil very tight when dry, dark-gray or brown dense tough subsoil—Irving soils.

Stream Bottoms Subject to Overflow:

Black to dark-brown, friable, permeable calcareous topsoil, black or dark-gray heavy but permeable subsoil—Trinity soils.

Black or very dark-brown moderately friable topsoil, black, brown or dark-gray moderately permeable subsoil non-calcareous—Johnston series.

Brown friable calcareous permeable topsoil, brown or grayish friable and permeable subsoil—Catalpa soils.

Brown or reddish-brown non-calcareous topsoil with heavy red clay subsoil—Milam soils.

Timbered Uplands of the East Texas Timber Country:

Light-brown to gray topsoil with yellow subsurface red and gray mottled dense very slowly permeable subsoil—Susquehanna soils.

Table 16. Analyses of soils of Navarro County

Laboratory number		Nitrogen per cent	Total phos. ac. per cent	Active phos. ac. per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH	Depth inches
26079	Bell clay	.076	.041	126	.88	----	244	----	2.61	7.4	0-7
26080	Bell clay	.048	.041	108	.90	----	172	----	3.59	7.5	7-19
26089	Catalpa clay	.101	.112	333	1.02	----	483	----	7.12	7.7	0-7
26090	Catalpa clay	.106	.115	326	1.84	----	423	----	7.41	7.5	7-19
26125	Catalpa silty clay loam	.121	.092	324	1.54	.33	604	.88	1.66	7.1	0-7
26126	Catalpa silty clay loam	.094	.076	248	1.53	.28	392	.79	1.54	7.1	7-19
26099	Crockett clay loam	.057	.039	11	2.00	.55	282	.77	1.47	6.2	0-7
26100	Crockett clay loam	.087	.027	13	1.63	.28	360	.56	1.14	6.5	7-19
Average	Crockett fine sandy loam	.061	.040	59	1.05	.13	210	.19	.28	6.5	surface
Average	Crockett fine sandy loam	.083	.032	38	1.07	.17	215	.34	.61	6.3	subsoil
26083	Ellis clay	.063	.076	45	2.30	.60	386	.68	1.56	7.1	0-7
26084	Ellis clay	.058	.107	206	2.45	.63	344	1.07	2.27	7.5	7-19
Average	Houston black clay	.112	.074	259	1.42	.53	491	2.15	4.64	7.4	surface
Average	Houston black clay	.090	.062	182	1.44	.27	302	4.29	5.39	7.6	subsoil
Average	Houston clay	.105	.064	166	1.36	.26	280	.81	4.86	7.3	surface
Average	Houston clay	.074	.064	174	1.16	.23	176	1.08	4.57	7.3	subsoil
Average	Irving clay	.084	.034	41	.89	.34	226	1.08	1.46	6.9	surface
Average	Irving clay	.069	.024	23	.74	.33	172	1.10	1.54	6.8	subsoil
26117	Irving clay loam	.081	.027	18	.63	.25	143	.76	1.43	7.1	0-7
26118	Irving clay loam	.118	.073	246	.59	.23	175	.23	1.01	6.8	7-19
Average	Irving fine sandy loam	.062	.026	37	.80	.14	138	.40	.51	6.6	surface
Average	Irving fine sandy loam	.050	.018	10	.84	.17	94	.43	1.29	6.4	subsoil
26077	Lewisville clay, shallow phase	.126	.081	218	1.04	.39	188	5.48	8.30	7.3	0-7
26078	Lewisville clay, shallow phase	.076	.067	8	1.00	.35	66	11.63	10.00	7.4	7-19
26121	Milam fine sandy loam	.024	.017	11	.69	.11	101	.11	.20	6.2	0-7
26122	Milam fine sandy loam	.038	.022	5	1.09	.32	164	.24	.68	5.4	7-19
26123	Myatt silty clay loam	.058	.024	17	.84	.15	181	.17	.29	5.7	0-7
26124	Myatt silty clay loam	.045	.019	12	1.02	.46	182	.42	.76	5.3	7-19
26105	Ochlockonee fine sandy loam	.056	.071	240	1.38	----	269	----	.78	7.2	0-7

Table 16. Analyses of soils of Navarro County—Continued

Laboratory number		Nitrogen per cent	Total phos. ac. per cent	Active phos. ac. per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH	Depth inches
26106	Ochlockonee fine sandy loam	.045	.062	232	1.48	----	176	----	.90	6.7	7-19
26107	Oktibbeha fine sandy loam	.056	.028	20	.58	----	193	----	.23	6.0	0-7
26108	Oktibbeha fine sandy loam	.034	.016	5	.70	----	143	----	1.04	5.4	7-19
Average	Sumter clay	.192	.095	34	1.57	.62	375	9.41	6.42	7.4	surface
Average	Sumter clay	.130	.103	54	1.55	.57	184	15.54	8.65	7.5	subsoil
26111	Susquehanna fine sandy loam	.040	.029	65	1.68	.05	171	.07	.05	6.5	0-7
26112	Susquehanna fine sandy loam	.045	.036	17	1.61	.20	418	.14	.20	6.5	7-19
26109	Tabor fine sandy loam	.046	.034	13	1.68	.07	92	.13	.25	6.7	0-7
26110	Tabor fine sandy loam	.037	.017	3	1.38	.09	87	.18	.39	6.7	7-19
Average	Trinity clay	.153	.104	185	1.00	----	498	----	6.41	7.2	surface
Average	Trinity clay	.129	.129	151	1.41	.51	358	2.16	4.76	7.2	subsoil
26115	Wilson clay	.075	.032	29	1.18	----	205	----	1.20	7.0	0-7
26116	Wilson clay	.059	.021	15	1.20	----	164	----	1.05	6.7	7-19
Average	Wilson clay loam	.107	.035	19	.64	----	130	----	.85	6.5	surface
Average	Wilson clay loam	.129	.030	11	.68	----	122	----	1.01	6.3	subsoil
Average	Wilson fine sandy loam	.055	.040	21	.95	.06	119	.19	.27	6.4	surface
Average	Wilson fine sandy loam	.048	.018	12	.95	.09	76	.22	.36	6.5	subsoil

Table 17. Interpretation of analyses of surface soils of Navarro county

Laboratory number		Corn possibility two million pounds			Total phosphoric acid	Acid-soluble potash	Acid-soluble lime
		Active phosphoric acid	Total nitrogen	Active potash			
26079	Bell clay	45	23	115	good	good	high
26089	Catalpa clay	50	33	204	good	good	high
26125	Catalpa silty clay loam	50	38	239	good	good	good
26099	Crockett clay loam	12	18	135	good	good	good
Average	Crockett fine sandy loam	30	23	105	fair	fair	fair
26083	Ellis clay	30	23	171	good	good	good
Average	Houston black clay	50	33	204	good	good	high
Average	Houston clay	45	33	135	good	good	good
Average	Irving clay	30	28	115	good	good	good
26117	Irving clay loam	12	28	73	low	good	good
Average	Irving fine sandy loam	24	23	73	low	fair	good
26077	Lewisville clay, shallow phase	50	38	94	good	good	high
26121	Milam fine sandy loam	12	13	61	low	fair	fair
26123	Myatt silty clay loam	12	18	94	low	fair	fair
26105	Ochlockonee fine sandy loam	50	18	125	good	good	fair
26107	Oktibbeha fine sandy loam	12	18	94	low	fair	fair
Average	Sumter clay	24	53	163	good	good	high
26111	Susquehanna fine sandy loam	35	13	84	low	low	low
26109	Tabor fine sandy loam	12	18	50	fair	low	fair
Average	Trinity clay	45	43	204	good	good	high

Table 18. Pot experiments on soils of Navarro county

Laboratory number	Type name	Weight crop in grams: With complete fertilizer	Weight crop in grams: Without phosphoric acid	Weight crop in grams: Without nitrogen	Weight crop in grams: Without potash	Corn possibility of plant food withdrawn in bushels: Phosphoric acid	Corn possibility of plant food withdrawn in bushels: Nitrogen	Corn possibility of plant food withdrawn in bushels: Potash
25970	Crockett fine sandy loam, subsoil, corn	32.2	9.6	14.9	26.7	11	20	225
"	Crockett fine sandy loam, subsoil, kafir	34.6	11.4	4.2	32.1	9	8	113
25961	Houston black clay, surface, corn	31.0	29.8	18.8	31.2	53	28	594
"	Houston black clay, surface, kafir	30.7	31.5	6.0	30.4	60	14	384
25962	Houston black clay, subsoil, corn	21.7	13.1	15.7	20.7	24	26	339
"	Houston black clay, subsoil, kafir	42.1	32.8	5.1	36.2	30	10	211
25967	Houston clay, surface, corn		44.3	35.0		76	51	
"	Houston clay, surface, kafir		49.5	8.8		52	19	
"	Houston clay, surface, cotton		29.3	21.0		319	62	
25968	Houston clay, subsoil, corn	24.5	9.8	13.1	22.0	17	31	209
"	Houston clay, subsoil, kafir	24.5	17.7	5.2	25.3	19	12	139
"	Houston clay, subsoil, cotton	27.7	18.4			26		
25960	Irving clay, subsoil, corn	25.0	12.3	13.2	25.7	16	19	237
"	Irving clay, subsoil, kafir	38.2	19.3	4.2	31.9	20	8	117
25965	Trinity clay, surface, corn	20.0	23.5	18.8	17.5	54	27	415
"	Trinity clay, surface, kafir	36.2	39.5	8.2	47.4	97	19	604
25966	Trinity clay, subsoil, corn	29.5	20.7	20.0	29.5	44	32	450
"	Trinity clay, subsoil, kafir	46.3	44.3	6.5	43.4	57	12	344
25971	Wilson clay loam, surface, corn	25.5	15.6	12.7	23.8	23	19	145
"	Wilson clay loam, surface, kafir	34.8	12.1	7.7	35.7	15	14	121
25972	Wilson clay loam, subsoil, corn	26.5	9.0	11.6	27.5	11	16	127
"	Wilson clay loam, subsoil, kafir	36.6	13.4	3.4	28.0	11	6	64
25963	Wilson fine sandy loam, surface, corn	32.5	18.6	9.9	29.3	23	16	145
"	Wilson fine sandy loam, surface, kafir	31.8	14.6	6.7	34.4	22	12	69
25964	Wilson fine sandy loam, subsoil, corn	33.0	8.5	13.9	25.0	10	21	110
"	Wilson fine sandy loam, subsoil, kafir	19.1	6.9	2.6	31.4	9	7	89

Light-brown to gray topsoil with yellow subsurface yellow with gray mottlings rather dense but moderately permeable subsoil—Tabor soils.

Flat to Undulating Old Stream Benches above Overflow:

Gray topsoil becomes tight on drying, gray, dense, very slowly permeable, subsoil—Myatt soils.

Gray topsoil with heavy mottled, red, reddish-gray and yellow stiff sandy clay—Oktibbeha soils.

SOILS OF VICTORIA COUNTY

Victoria County is in south-central Texas in the Gulf Coast Prairie. Thirty-one types of soil belonging to 18 series have been mapped in this county. The flat coastal prairies are occupied chiefly by the Lake Charles soils. The upland prairie soils include the Edna, Hockley, Katy, Duval, Norfolk, Susquehanna, Wilson, DeWitt, and Goliad series. The Blackland terrace soils include Milam and Bell soils. The Harris soils are found on marshy and poorly drained areas. The stream bottoms subject to overflow are occupied by the Guadalupe, Johnson, Catalpa, and Trinity soils. The Lake Charles clay occupies 21.1 per cent of the area, the Edna fine sandy loam 20.7, and the Hockley fine sandy loam 14.8. The Lake Charles clay loam comes next with 8.8 per cent, the Trinity clay with 7.5 per cent and the Dewitt fine sandy loam with 5.1 per cent.

Composition of Soils

Table 19 gives the chemical composition of the various soil types and Table 20 an interpretation of the analyses. Some of these soils are well supplied with plant food but a number of them are low both in nitrogen and in active phosphoric acid and are somewhat better supplied with potash. Some of the soils are slightly acid but most of them are neutral and some are basic and are limestone soils. The soils of the DeWitt, Edna, Goliad, Hockley, and Lake Charles series are somewhat low in active phosphoric acid. Phosphoric acid is likely to be needed on these soils within a short time.

Pot experiments are given in Table 21. It is noticed that while some of these soils do not respond to nitrogen or phosphoric acid, many of them respond quite decidedly. Their response to potash is usually small. With the Edna fine sandy loam, for example, the crop produced without nitrogen and without phosphoric acid is much smaller than that produced with nitrogen and phosphoric acid but without potash. The same applied to the Hockley fine sandy loam, the Lake Charles clay, and other soils.

Fertilizers

Many of these soils are low in active phosphoric acid and need applications of fertilizer containing phosphoric acid. Some of them are low in

Laboratory number		Nitrogen per cent	Total phos. ac. per cent	Active phos. ac. per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH	Depth inches
26751	Bell clay	.149	.097	216	1.75	.55	401	5.70	9.67	7.6	0-7
26752	Bell clay	.112	.060	58	1.53	.44	121	7.20	13.20	7.7	7-19
Average	Catalpa clay	.153	.092	101	1.42	.52	309	6.39	16.54	7.4	surface
Average	Catalpa clay	.105	.074	36	1.26	.42	103	8.01	19.70	7.5	subsoil
Average	DeWitt fine sandy loam	.043	.016	18	.40	.07	92	.16	.16	6.8	surface
Average	DeWitt fine sandy loam	.029	.012	8	.42	.09	68	.18	.31	6.6	subsoil
26785	Edna fine sandy clay loam	.086	.024	22	.22	.10	88	.19	.47	5.8	0-7
26786	Edna fine sandy clay loam	.041	.015	9	.30	.09	57	.27	.51	6.3	7-19
Average	Edna fine sandy loam	.054	.018	15	.56	.11	111	.27	.41	6.2	surface
Average	Edna fine sandy loam	.049	.018	10	.54	.12	84	.22	.59	6.4	subsoil
Average	Goliad clay loam	.147	.030	41	.65	.25	290	1.72	2.21	7.4	surface
Average	Goliad clay loam	.105	.021	13	.70	.24	96	5.49	9.59	7.5	subsoil
Average	Goliad fine sandy loam	.115	.027	19	.82	.23	216	.60	1.00	7.4	surface
Average	Goliad fine sandy loam	.095	.024	9	1.00	.27	169	.60	1.04	7.0	subsoil
Average	Guadalupe clay	.159	.089	64	1.36	.68	358	13.25	24.10	7.2	surface
Average	Guadalupe clay	.129	.088	47	1.21	.70	410	13.71	24.60	7.4	subsoil
26729	Guadalupe silty clay loam	.136	.058	92	1.47	.31	241	6.42	11.40	7.2	0-7
26730	Guadalupe silty clay loam	.095	.048	41	1.33	.30	75	6.67	12.30	7.5	7-19
Average	Hockley fine sandy loam	.050	.021	16	.27	.12	93	.15	.19	6.4	surface
Average	Hockley fine sandy loam	.046	.017	8	.36	.16	93	.35	.57	6.3	subsoil
26753	Katy fine sandy loam	.070	.025	19	1.18	.12	181	.20	.28	6.6	0-7
26754	Katy fine sandy loam	.073	.024	8	1.24	.39	167	.40	.65	6.3	7-19
Average	Lake Charles clay	.110	.038	44	.95	.61	327	3.38	3.28	6.1	surface
Average	Lake Charles clay	.072	.030	29	.77	.52	230	3.56	3.17	7.2	subsoil
26747	Lake Charles clay loam	.129	.031	40	1.11	.23	352	.50	1.20	6.2	0-7
26748	Lake Charles clay loam	.094	.025	20	1.15	.29	140	.71	1.50	6.6	7-19
Average	Lake Charles fine sandy loam	.082	.024	22	.60	.15	129	.22	.36	6.7	surface
Average	Lake Charles fine sandy loam	.058	.018	9	1.06	.21	108	.25	.58	6.5	subsoil
3572	Lake Charles loam	.094	.013	23	.31	.57	133	.46	.92	---	0-8
3573	Lake Charles loam	.055	.018	10	---	.79	80	.52	1.02	---	8-36
26737	Norfolk fine sand	.033	.018	14	.46	.09	54	.07	.13	7.0	0-7
26738	Norfolk fine sand	.010	.016	9	.58	.10	36	.03	.10	7.4	7-19
26769	Susquehanna fine sandy loam	.029	.018	20	.23	.04	124	.04	.11	6.9	0-7
26770	Susquehanna fine sandy loam	.049	.023	7	.31	.13	94	.28	.56	6.7	7-19
Average	Trinity clay	.130	.094	52	1.31	1.01	230	11.16	20.00	7.3	surface
Average	Trinity clay	.095	.084	31	1.19	.78	107	14.22	23.50	7.6	subsoil
26761	Trinity fine sandy clay loam	.096	.088	310	1.02	.33	233	6.02	9.72	7.6	0-7
26762	Trinity fine sandy clay loam	.087	.085	132	1.29	.27	82	8.47	15.50	7.6	7-19
26763	Trinity fine sandy loam	.067	.100	265	1.06	.20	223	8.33	14.80	7.5	0-7
26764	Trinity fine sandy loam	.057	.067	150	.99	.19	107	9.33	18.00	7.6	7-19
26775	Wilson clay	.189	.036	39	.90	.58	482	.94	1.80	7.3	0-7
26776	Wilson clay	.144	.025	22	.88	.50	265	.95	1.81	7.1	7-19
26779	Wilson fine sandy loam	.062	.015	14	.21	.17	122	.22	1.04	6.8	0-7
26780	Wilson fine sandy loam	.079	.017	15	.21	.31	149	.84	2.28	7.2	7-19

Table 20. Interpretation of analyses of surface soils of Victoria county

Laboratory number		Corn possibility two million pounds: Active phosphoric acid	Corn possibility two million pounds: Total nitrogen	Corn possibility two million pounds: Active potash	Total phosphoric acid	Acid-soluble potash	Acid-soluble lime
26751	Bell clay	50	43	180	good	good	high
Average	Catalpa clay	45	43	144	good	good	high
Average	Dewitt fine sandy loam	12	18	50	low	low	fair
26785	Edna fine sandy clay loam	18	28	50	low	low	fair
Average	Edna fine sandy loam	12	18	61	low	fair	good
Average	Goliad clay loam	30	43	135	low	good	good
Average	Goliad fine sandy loam	12	33	105	low	good	good
Average	Guadalupe clay	35	43	163	good	good	high
26729	Guadalupe silty clay loam	40	38	115	good	good	high
Average	Hockley fine sandy loam	12	18	50	low	fair	fair
26753	Katy fine sandy loam	12	23	94	low	fair	fair
Average	Lake Charles clay	30	33	154	good	good	high
26747	Lake Charles clay loam	24	38	163	good	good	good
Average	Lake Charles fine sandy loam	18	28	73	low	fair	good
3572	Lake Charles loam	18	28	73	low	good	good
26737	Norfolk fine sand	12	13	38	low	fair	fair
26769	Susquehanna fine sandy loam	12	13	61	low	low	low
Average	Trinity clay	30	38	115	good	good	high
26761	Trinity fine sandy clay loam	50	28	115	good	good	high
26763	Trinity fine sandy loam	50	23	105	good	good	high
26775	Wilson clay	24	53	204	low	good	good
26779	Wilson fine sandy loam	12	23	61	low	good	good

Table 21. Pot experiments on soils of Victoria county

Laboratory number	Type name	Weight crop in grams				Corn possibility of plant food withdrawn, in bushels		
		With complete fertilizer	Without phosphoric acid	Without nitrogen	Without potash	Phosphoric acid	Nitrogen	Potash
26815	Catalpa clay, surface, corn	32.7	27.1	25.0		57	48	
”	Catalpa clay, surface, kafir	33.2	31.2	13.7		50	27	
26816	Catalpa clay, subsoil, corn		14.9	17.1	21.8	30	69	263
”	Catalpa clay, subsoil, kafir		15.5	12.5	22.2	25	27	149
26821	Edna fine sandy loam, surface, corn		18.2	25.8	40.5	21	35	175
”	Edna fine sandy loam, surface, kafir		13.9	7.2	19.7	15	17	19
26822	Edna fine sandy loam, subsoil, corn		3.8	11.8	37.3	6	14	134
”	Edna fine sandy loam, subsoil, kafir		7.5	4.8	16.0	7	12	19
26817	Guadalupe silty clay loam, surface, corn	29.8	22.7	19.9	31.1	41	35	591
”	Guadalupe silty clay loam, surface kafir	30.0	25.0	10.4	34.5	33	19	316
26818	Guadalupe silty clay loam, subsoil, corn	20.1	9.9	12.2	20.2	14	20	371
”	Guadalupe silty clay loam, surface, kafir	30.0	14.1	5.1	27.5	16	12	209
26819	Hockley fine sandy loam, surface, corn		22.1	18.5	39.0	26	23	122
”	Hockley fine sandy loam, surface, kafir		14.8	8.7	21.0	12	20	27
26820	Hockley fine sandy loam, subsoil, corn		3.9	14.2	34.7	6	17	112
”	Hockley fine sandy loam, subsoil, kafir		7.6	2.5	20.1	8	7	19
7091	Hockley fine sandy loam, probably, surface corn	43.2		19.4			23	
”	Hockley fine sandy loam, probably, surface sorghum	29.4		6.5			14	
7092	Hockley fine sandy loam, probably, subsoil, corn	34.6			36.1			177
”	Hockley fine sandy loam, probably, subsoil, sorghum	21.6			10.1			25
26823	Lake Charles clay, surface, corn		19.1	23.2	35.0	28	30	511
”	Lake Charles clay, surface, kafir		18.4	22.0	22.5	18	45	159
26824	Lake Charles clay, subsoil, corn		16.9	16.7	37.7	22	23	317
”	Lake Charles clay, subsoil, kafir		15.6	9.1	36.5	17	17	149
7373	Lake Charles clay, probably, surface, corn	32.3			33.5			592
”	Lake Charles clay, probably, surface, sorghum	27.0			24.1			188
7374	Lake Charles clay, probably, subsoil, corn	28.3	22.5			30		
”	Lake Charles clay, probably, subsoil, sorghum	26.2	14.9			14		
26813	Trinity clay, surface, corn		12.8	16.5	20.1	24	38	384
”	Trinity clay, surface, kafir		11.3	5.3	15.3	22	16	170
26814	Trinity clay, subsoil, corn	20.8	9.9	17.1	18.8	14	29	239
”	Trinity clay, subsoil, kafir	16.0	9.1	2.8	15.3	12	7	112

nitrogen and the need for nitrogen will increase as they are cultivated. Potash is less likely to be needed but the need will probably develop after the soils have been in cultivation a longer period of time. No need for an application of lime is indicated.

Classification of Soils of Victoria County

Flat Coastal Prairie Soils:

Black, dark gray, or brown, not calcareous, topsoil fairly tight when dry, with heavy black or gray subsoil not calcareous, slowly penetrated by water—Lake Charles soils.

Upland Prairie Soils of Coastal Prairie:

Light-brown to gray, generally sandy topsoil which becomes tight on drying with dense gray clay subsoil, almost impervious to water—Edna soils.

Light-brown to gray, mostly sandy, topsoil with dense, mottled gray and yellow, clay subsoil—Hockley soils.

Light-brown to gray,mostly sandy, topsoil with dense, mottled gray red and yellow, clay subsoil—Katy soils.

Gray topsoil with yellow subsurface, yellow, very permeable, and sandy subsoils—Norfolk soils.

Light-brown to gray topsoil with yellow subsurface and red and gray mottled, dense, very slowly permeable subsoil—Susquehanna soils.

Reddish or reddish-brown, not calcareous, friable topsoil with red, non-calcareous, crumbly subsoil—Duval soils.

Black to dark-gray topsoils, very tight when dry, non-calcareous, with brown or dark-gray, dense, tough subsoils—Wilson soils.

Dark-brown to black, non-calcareous, friable topsoil with red or reddish-brown subsoil, calcareous in the lower part—Goliad soils.

Grayish-brown or brown topsoil, with dense, heavy yellow clay, mottled with gray or yellowish-brown and gray subsoil—DeWitt soils.

Flat to Undulating Old Stream Benches above Overflow.

Black to dark-brown friable topsoil with dark-gray to brown crumbly subsoil, calcareous—Bell soils.

Brown or reddish-brown topsoil with brown, yellow, or red sub-surface and heavy red clay subsoil, not calcareous—Milam soils.

Flat Marshy or Semi-Marshy Prairie:

Gray to brown salty topsoil with gray or brown dense clay subsoil, water table high—Harris soils.

Flat Stream Bottoms Subject to Overflow:

Black or very dark-brown moderately friable topsoil with brown, black or dark-gray moderately crumbly and permeable subsoil, non-calcareous—Johnston soils.

Brown friable permeable calcareous topsoil with brown or grayish friable and permeable subsoil—Catalpa soils.

Black to dark-brown friable, permeable, calcareous topsoil with **black** or dark-gray, heavy permeable and crumbly, subsoil—Trinity soils.

Brown or light ash-brown topsoil with light-brown to grayish-brown or yellowish-brown calcareous subsoil—Guadalupe soils.

SOILS OF WICHITA COUNTY

Wichita County is in the extreme north-central part of Texas and is located in the geographical division termed the Rolling Plains. Twenty-five soil types grouped in 9 soil series are mapped in this county. The upland soils include the Enterprise, Foard, Vernon, and Fowlkes soils. The terrace soils include the Wichita and Calumet soils. The stream bottoms carry the Miller, Yahola, and Portland soils. The most extensive soil is the Foard very fine sandy loam, which occupies 15.5 per cent of the area followed closely by the Vernon clay loam occupying 15.2 per cent, the Vernon very fine sandy loam occupying 9.5, the Calumet very fine sandy loam, 7.4 per cent, and the Enterprise loamy very fine sand, 5.8 per cent.

Composition of Soils

The chemical composition of the various types are given in Table 22 and an interpretation of the analyses in Table 23. The soils are fairly well supplied with nitrogen and phosphoric acid and are much better supplied with potash. As usual, the bottom lands are richest in plant food, the terrace soils come next, and the uplands the lowest. The Calumet fine sandy loam, the Wichita sandy loam and the Wichita very fine sandy loam are low in phosphoric acid. The soils are likely to need nitrogen first, phosphoric acid second, and potash last. Practically all of these soils contain good amounts of lime and none of them are acid in character.

Pot Experiments

Pot experiments are given in Table 24. It is noted that nitrogen and phosphoric acid gave increases in crop yields with some of these soils, such as the Foard very fine sandy loam and the Enterprise loamy very fine sand.

Fertilizers

The supply of water is the limiting factor in these soils for crops grown without irrigation. At the present time, the use of fertilizers on field crops cannot be recommended excepting for experimental purposes or after the soils have been in cultivation for a long period of time. It is possible that nitrogen first, then phosphoric acid, then potash, may

Table 22. Analyses of soils of Wichita County

Laboratory number		Nitrogen per cent	Total phos. ac. per cent	Active phos. ac. per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH	Depth inches
21532	Calumet fine sandy loam	.079	.043	44	.99	.16	310	.19	.40	7.1	0-10
21533	Calumet fine sandy loam	.072	.039	23	1.24	.22	210	.28	.65	6.8	10-22
21534	Calumet fine sandy loam	.046	.026	20	1.06	.25	140	.35	.80	7.1	22-36
21591	Calumet silty clay loam	.091	.061	109	1.97	.63	420	.49	.90	6.7	0-8
21592	Calumet silty clay loam	.044	.045	79	2.05	.54	231	.51	1.15	7.1	8-18
21593	Calumet silty clay loam	.041	.042	113	1.74	.52	256	1.33	2.30	7.7	18-36
Average	Calumet very fine sandy loam	.078	.042	72	1.35	.27	295	.29	.54	7.0	surface
Average	Calumet very fine sandy loam	.061	.046	21	1.58	.64	255	.51	1.00	7.2	subsoil
Average	Calumet very fine sandy loam	.043	.035	39	1.43	.45	243	.81	1.60	7.7	deep subsoil
Average	Enterprise loamy very fine sand	.048	.065	231	1.73	.14	213	.19	.44	7.0	surface
Average	Enterprise loamy very fine sand	.035	.059	175	1.64	.18	132	.19	.46	7.0	subsoil
21517	Foard clay	.065	.053	54	1.15	.44	202	.61	1.60	7.8	0-8
21518	Foard clay	.055	.047	74	1.11	.40	177	1.17	2.55	7.8	8-16
21519	Foard clay	.032	.052	160	1.10	.42	260	1.76	3.30	7.7	16-36
Average	Foard clay loam	.094	.051	68	1.24	.45	282	.44	1.02	6.9	surface
Average	Foard clay loam	.066	.040	45	1.39	.58	163	.58	1.64	7.2	subsoil
Average	Foard clay loam	.030	.035	56	.80	.50	136	4.47	6.58	8.5	deep subsoil
Average	Foard very fine sandy loam	.079	.045	67	1.26	.28	202	.26	.47	6.7	surface
Average	Foard very fine sandy loam	.057	.043	38	.93	.53	165	.46	1.99	7.3	subsoil
Average	Foard very fine sandy loam	.047	.036	29	1.44	.57	175	.70	2.12	7.8	deep subsoil
Average	Fowlke very fine sandy loam	.071	.043	51	1.25	.32	279	.35	.70	7.2	surface
Average	Fowlke very fine sandy loam	.061	.036	20	1.02	.52	180	.64	1.15	7.4	subsoil
Average	Fowlke very fine sandy loam	.053	.035	15	1.08	.57	131	.51	1.10	7.2	deep subsoil
21558	Miller clay	.067	.125	545	3.83	1.73	588	2.61	6.25	7.6	0-12
21559	Miller clay	.059	.119	512	3.80	1.73	448	2.64	6.25	7.6	12-36
Average	Miller silty clay loam	.080	.086	370	2.44	.60	540	1.81	3.63	7.4	surface
Average	Miller silty clay loam	.057	.084	334	1.90	.98	286	2.19	5.06	7.5	subsoil
Average	Miller silty clay loam	.045	.099	449	3.59	1.50	219	3.39	6.80	7.6	deep subsoil
Average	Miller very fine sandy loam	.078	.055	187	1.33	.40	284	.71	1.70	7.3	surface
Average	Miller very fine sandy loam	.052	.056	205	1.33	.41	174	1.40	2.94	7.3	subsoil
Average	Miller very fine sandy loam	.055	.064	216	1.77	.76	247	1.56	3.17	7.3	deep subsoil
Average	Portland clay loam	.111	.072	137	2.03	.49	322	.42	.83	6.8	surface
Average	Portland clay loam	.072	.057	69	1.62	.39	204	.40	.90	6.9	subsoil
Average	Portland clay loam	.039	.042	93	1.67	.43	129	.36	.99	7.7	deep subsoil
21526	Portland very fine sandy loam	.103	.049	96	1.13	.18	315	.28	.50	7.2	0-10

Laboratory number		Nitrogen per cent	Total phos. ac. per cent	Active phos. ac. per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH	Depth inches
21527	Portland very fine sandy loam	.063	.048	69	1.24	.25	226	.24	.50	6.8	10-24
21528	Portland very fine sandy loam	.063	.036	42	1.09	.28	174	.33	.65	7.1	24-36
Average	Vernon clay	.066	.069	159	1.57	.64	245	2.08	3.32	7.4	surface
Average	Vernon clay	.057	.061	137	1.93	.62	146	1.63	2.73	7.5	subsoil
Average	Vernon clay	.044	.058	135	2.13	.77	176	1.46	2.60	8.1	deep subsoil
Average	Vernon clay loam	.112	.051	52	1.52	.41	258	.49	2.69	7.3	surface
Average	Vernon clay loam	.064	.044	16	1.32	.54	177	.53	4.60	7.4	subsoil
Average	Vernon clay loam	.040	.047	16	.83	.43	103	4.07	9.28	7.9	deep subsoil
Average	Vernon very fine sandy loam	.085	.047	52	1.33	.40	213	.40	.58	6.6	surface
Average	Vernon very fine sandy loam	.063	.042	17	.95	.50	145	.49	.86	6.9	subsoil
Average	Vernon very fine sandy loam	.032	.038	46	.89	.42	72	5.62	5.95	7.6	deep subsoil
Average	Wichita clay loam	.109	.086	304	1.58	.63	590	1.18	2.00	7.3	surface
Average	Wichita clay loam	.065	.050	55	1.76	.69	165	2.84	2.10	7.6	subsoil
Average	Wichita clay loam	.046	.045	89	1.82	.86	145	2.58	4.35	7.8	deep subsoil
Average	Wichita fine sandy loam	.072	.049	78	1.61	.16	398	.20	.24	7.1	surface
Average	Wichita fine sandy loam	.073	.051	17	2.22	.58	957	.24	.65	7.1	subsoil
Average	Wichita fine sandy loam	.054	.032	16	1.77	.52	435	.25	.46	7.1	deep subsoil
21514	Wichita sandy loam	.046	.039	10	1.51	.24	230	.15	.40	7.2	0-10
21515	Wichita sandy loam	.053	.043	5	1.23	.39	210	.24	.60	7.1	10-22
21516	Wichita sandy loam	.028	.030	5	1.11	.31	126	.19	.40	7.0	22-36
Average	Wichita very fine sandy loam	.078	.046	61	1.57	.39	353	.28	.51	6.9	surface
Average	Wichita very fine sandy loam	.069	.044	43	1.74	.70	244	.47	.83	7.2	subsoil
Average	Wichita very fine sandy loam	.055	.037	14	1.72	.57	205	.61	1.01	7.3	deep subsoil
Average	Yahola loamy fine sand	.021	.053	294	1.64	.34	137	3.60	3.68	7.5	surface
Average	Yahola loamy fine sand	.023	.055	318	1.75	.48	141	3.17	6.54	7.7	subsoil
21520	Yahola loamy very fine sand	.068	.082	435	1.55	.68	697	2.43	6.05	7.6	0-8
21521	Yahola loamy very fine sand	.027	.061	351	1.50	.60	248	2.57	5.90	7.7	8-24
21522	Yahola loamy very fine sand	.023	.064	345	1.37	.57	178	2.42	5.60	7.7	24-36
Average	Yahola silty clay loam	.068	.148	457	2.88	1.27	463	2.52	5.08	7.5	surface
				458	2.59	.78	291	2.86	5.92	7.6	subsoil
Average	Yahola silty clay loam	.054	.085								
Average	Yahola silty clay loam	.029	.076	394	2.03	.62	143	2.89	6.12	7.8	deep subsoil
Average	Yahola very fine sandy loam	.086	.082	378	2.32	.67	436	1.01	3.22	7.3	surface
Average	Yahola very fine sandy loam	.045	.076	400	1.99	.64	351	.33	5.22	7.6	subsoil
Average	Yahola very fine sandy loam	.025	.061	362	1.69	.64	256	2.61	5.58	7.6	deep subsoil

Table 23. Interpretation of analyses of surface soils of Wichita county

Laboratory number		Corn possibility two million pounds			Total phosphoric acid	Acid-soluble potash	Acid-soluble lime
		Active phosphoric acid	Total nitrogen	Active potash			
21532	Calumet fine sandy loam	30	23	144	fair	fair	fair
21591	Calumet silty clay loam	45	28	180	good	good	good
Average	Calumet very fine sandy loam	35	23	135	good	good	good
Average	Enterprise loamy very fine sand	50	18	105	fair	good	good
21517	Foard clay	30	23	105	good	good	good
Average	Foard clay loam	35	28	135	good	good	good
Average	Foard very fine sandy loam	35	23	105	good	good	good
Average	Fowlke very fine sandy loam	30	23	135	good	good	good
21558	Miller clay	55	23	232	good	good	high
Average	Miller silty clay loam	50	23	219	good	good	good
Average	Miller very fine sandy loam	45	23	135	good	good	good
Average	Portland clay loam	45	33	144	good	good	good
21526	Portland very fine sandy loam	40	33	144	good	good	good
Average	Vernon clay	45	23	115	good	good	high
Average	Vernon clay loam	30	33	125	good	good	good
Average	Vernon very fine sandy loam	30	28	105	good	good	good
Average	Wichita clay loam	50	33	232	good	good	good
Average	Wichita fine sandy loam	35	23	171	fair	good	fair
21514	Wichita sandy loam	6	18	115	fair	good	fair
Average	Wichita very fine sandy loam	35	23	163	good	good	good
Average	Yahola loamy fine sand	50	13	73	good	good	high
21520	Yahola loamy very fine sand	55	23	256	good	good	high
Average	Yahola silty clay loam	55	23	196	good	good	high
Average	Yahola very fine sandy loam	50	28	188	good	good	good

give results. Conditions with crops grown under irrigation are somewhat different and it is probable that fertilizers may be of benefit especially on truck or vegetable crops. The soils contain an abundance of lime and do not need liming.

Classification of Soils of Wichita County

Upland soils:

Brown to very dark-brown topsoil, tight when dry, non-calcareaus; brown or dark-brown subsoil, non-calcareous, dense and tough—Foard soils.

Red or reddish-brown, calcareous topsoil, tight when dry, red, calcareous, tight and dense subsoil—Fowlkes soils.

Red or reddish-brown, calcareous, friable topsoil with red, calcareous, crumbly subsoil—Vernon soils.

Brown or dull-red, friable, non-calcareous, topsoil with brown, red, or yellowish, non-calcareous, crumbly subsoil—Enterprise soils.

Flat to undulating old stream benches above overflow:

Red or brown, non-calcareous, friable topsoil with red, non-calcareous, crumbly subsoil—Wichita soils.

Brown topsoil with chocolate-brown or yellow, stiff, dense, clay subsoil, non-calcareous—Calumet soils.

Flat stream bottoms subject to overflow:

Red calcareous, friable topsoil with red, calcareous, crumbly subsoil —Miller soils.

Red, calcareous, friable topsoil, red, calcareous, subsoils, lighter in texture than the surface soils—Yahola series.

Chocolate-brown topsoil with light chocolate-brown or reddish-brown subsoils, non-calcareous—Portland soils.

SOILS OF WILLACY COUNTY

Willacy County is in the extreme southern part of Texas, and in the soil area known as the Rio Grande Plains. Nineteen soil types belonging to 10 series have been mapped in this county. The dark-colored upland soils are the Victoria and Willacy series. The light-colored upland soils are the Nueces and Raymondville soils. The Rio Grande Valley soils are represented by the Laredo series. Poorly drained semi-marshy and associated soils of the flat coast border are classed as the Lomalto soils. The flat ridges are occupied by the Point Isabel and Tiocano soils. There are also dune sand and the coastal beach. The Willacy fine sandy loam occupies 21.6 per cent of the area, while the Victoria clay loam occupies 21.8 per cent. The Nueces fine sand is mapped on 13 per cent of the area,

Table 24. Pot experiments on soils of Wichita county

Labora tory number	Type name	Weight crop in grams				Corn possibility of plant food withdrawn, in bushels		
		With complete fertilizer	Without phosphoric acid	Without nitrogen	Without potash	Phosphoric	Nitrogen	Potash
22236	Calumet very fine sandy loam, surface, corn	39.0	30.6	18.2	40.3			
"	Calumet very fine sandy loam, surface, kafir	43.2	20.3	8.2	44.4	41	24	364
"	Calumet very fine sandy loam, surface, cotton	27.9	28.4			27	15	222
22237	Calumet very fine sandy loam, subsoil, corn	34.0	8.7	14.2	32.9	57		
"	Calumet very fine sandy loam, subsoil, kafir	43.2	13.5	4.5	45.5	13	20	318
"	Calumet very fine sandy loam, subsoil, cotton	36.7	11.6			15	8	235
22224	Enterprise loamy very fine sand, surface	31.6	26.2	16.1		19		
22225	Enterprise loamy very fine sand, subsoil corn	44.4	13.3	11.5	42.4	53	28	
"	Enterprise loamy very fine sand, subsoil, kafir	35.3	16.9	3.7	35.2	22	15	149
"	Enterprise loamy very fine sand, subsoil, cotton	36.0	18.8			18	8	124
22230	Foard clay loam, surface, corn	45.1	27.2	27.3	38.5	32		
"	Foard clay loam, surface, kafir	29.7	25.4	14.7	30.4	52	44	517
22231	Foard clay loam, subsoil, corn	29.1	5.1			47	35	251
"	Foard clay loam, subsoil, kafir	33.3	9.9			10		
"	Foard clay loam, subsoil, cotton	31.0	13.2			13		
22238	Foard very fine sandy loam, surface, corn	43.9	30.1	22.2	42.7	16		
"	Foard very fine sandy loam, surface, kafir	45.2	25.6	16.2	41.0	38	29	275
"	Foard very fine sandy loam, surface, cotton	43.9	31.2			28	26	17
22239	Foard very fine sandy loam, subsoil, corn	17.6	7.3			56		
"	Foard very fine sandy loam, subsoil, kafir	5.9	6.5			18		
"	Foard very fine sandy loam, subsoil, cotton	25.2	13.2			17		
22235	Miller silty clay loam, subsoil, corn	19.7	8.0	10.7	10.0	28		
"	Miller silty clay loam, subsoil, kafir	22.6	13.0	6.0	26.5	16	22	33
"	Miller silty clay loam, subsoil, cotton	28.1	16.2			16	10	262
						29		

Table 24. Pot experiments on soils of Wichita county—*Continued*

Labora tory number	Type name	Weight crop in grams: With complete fertilizer	Without phosphoric acid	Without nitrogen	Without potash	Corn possibility of plant food withdrawn, in bushels: Phosphoric	Nitrogen	Potash
6976	Miller silty clay loam, probably, surface, corn	40.7	24.7			43		
"	Miller silty clay loam, probably, surface, sorghum	26.0	22.5			32		
6977	Miller silty clay loam, probably, subsoil, corn	45.5	13.6		43.5	17		395
"	Miller silty clay loam, probably, subsoil, sorghum	33.9	11.1		31.3	10		169
22228	Vernon clay loam, surface, corn	30.1	6.9	17.7		9	24	
"	Vernon clay loam, surface, kafir	9.9	6.6	3.8		7	8	
"	Vernon clay loam, surface, cotton	27.5	17.2			19		
22229	Vernon clay loam, subsoil, corn	13.2	5.2	7.6	11.4	8	14	96
"	Vernon clay loam, subsoil, kafir	7.4	4.5	2.5	7.8	6	7	54
"	Vernon clay loam, subsoil, cotton	14.0	4.9	8.0		9	23	
22226	Vernon very fine sandy loam, surface, corn	48.1	30.7	20.0	47.2	49	27	330
"	Vernon very fine sandy loam, surface, kafir	39.0	27.7	10.8	40.8	34	17	178
"	Vernon very fine sandy loam, surface, cotton	34.5	35.2			68		
22227	Vernon very fine sandy loam, subsoil, cotton	29.4	12.0	14.2		18	33	
22222	Wichita very fine sandy loam, surface, cotton	32.2	31.4	18.4		78	39	
22223	Wichita very fine sandy loam, subsoil, cotton	26.5	14.4	15.9		22	32	
22232	Yahola very fine sandy loam, surface, corn	27.7	30.4	23.8	32.9	51	34	569
"	Yahola very fine sandy loam, surface, kafir	9.0	13.9	11.2	9.0	33	26	119
22233	Yahola very fine sandy loam, subsoil, corn	31.0	20.2	16.0	30.7	31	25	386
"	Yahola very fine sandy loam, subsoil, kafir	30.2	21.5	3.7	35.7	25	8	234
"	Yahola very fine sandy loam, subsoil, cotton	28.1	25.0			42		

the Victoria fine sandy loam on 9.7 per cent, and the Victoria fine sandy clay loam on 9.4 per cent.

Composition of Soils

Table 25 gives the analyses of the different soil types and Table 26 an interpretation of the analyses. With the exception of the dune sand and the Nueces fine sand, the soils are well supplied with phosphoric acid. The dune sand, Laredo silty loam, Lomalto clay loam, Lomalto fine sandy loam, Nueces fine sand, Point Isabel clay, and Point Isabel fine sandy loam are somewhat low in nitrogen. The soils are well supplied with active potash. None of these soils are acid and most of them are, in fact, limestone soils. The Nueces fine sand is the only one low in lime.

Pot Experiments

Pot experiments are given in Table 27. It is to be noted that some of these soils respond to applications of nitrogen and a smaller number to applications of phosphoric acid. The Victoria clay loam and Victoria fine sandy loam as well as the Willacy fine sandy loam respond to nitrogen and in some cases to phosphoric acid.

Fertilizers

Although many of these soils are well supplied with plant food, those under cultivation are intensively cropped and in many cases are planted to vegetable or fruit crops which have high demands for available plant food. Under the intensive cropping the plant food is rapidly reduced and the use of fertilizers will be needed. Nitrogen and phosphoric acid will probably be needed to the greatest extent. Potash is more abundant in the soil and is less likely to be needed, although it will no doubt be needed under intensive cultivation of the soil.

Classification of Soils of Willacy County

Upland Soils:

Black to very dark-brown or dark gray-brown, calcareous, friable topsoil with dark-gray, brown, or yellowish, calcareous, crumbly subsoil—Victoria soils.

Brown, non-calcareous, friable topsoil with brown or yellowish, crumbly, subsoil, calcareous in lower part—Willacy soils.

Gray, non-calcareous, friable topsoil with gray or yellowish, non-calcareous, friable subsoil—Nueces soils.

Grayish-brown to dark ash-gray calcareous topsoil with ash-gray clay, calcareous subsoil—Raymondville soils.

Table 25. Analyses of soils of Willacy County

Laboratory number		Nitrogen per cent	Total phos. ac. per cent	Active phos. ac per million	Total potash per cent	Acid soluble potash per cent	Active potash per million	Acid soluble lime per cent	Basicity per cent	pH	Depth inches
25871	Dune sand	.009	.012	9	1.45	.07	68	.11	.41	6.7	0-7
25872	Dune sand	.009	.012	8	1.51	.06	56	.06	.42	6.8	7-19
25905	Laredo silt loam	.063	.103	113	1.11	----	766	----	16.49	7.5	0-7
25906	Laredo silt loam	.036	.086	148	1.11	----	181	----	12.50	7.5	7-19
25901	Lomalto clay	.101	.076	195	1.14	1.09	858	1.01	2.70	7.2	0-7
25902	Lomalto clay	.048	.052	41	1.97	.95	311	7.01	9.71	7.7	7-19
Average	Lomalto clay loam	.039	.043	124	2.28	.41	536	.32	1.77	7.4	surface
Average	Lomalto clay loam	.032	.043	85	2.32	.52	596	.41	2.38	7.7	subsoil
25873	Lomalto fine sandy loam	.045	.020	40	1.52	.12	124	.17	.46	6.8	0-7
25874	Lomalto fine sandy loam	.035	.024	40	1.66	.13	132	.18	.59	6.8	7-19
Average	Nueces fine sand	.033	.017	14	1.31	.11	133	.11	.08	6.5	surface
Average	Nueces fine sand	.027	.018	10	1.33	.16	142	.14	.13	6.8	subsoil
25877	Point Isabel clay	.071	.079	160	1.62	.63	349	5.74	9.49	7.7	0-7
25878	Point Isabel clay	.067	.080	146	1.73	.78	290	7.29	17.50	7.6	7-19
25869	Point Isabel fine sandy loam	.045	.061	275	2.23	.48	467	3.90	5.78	7.3	0-7
25870	Point Isabel fine sandy loam	.053	.069	286	2.32	.55	510	3.81	6.24	7.5	7-19
25897	Point Isabel fine sandy loam, high phase	.091	.069	156	1.91	.64	828	.57	1.07	7.5	0-7
25898	Point Isabel fine sandy loam, high phase	.079	.091	378	2.00	.67	499	2.45	4.54	7.7	7-19
25893	Raymondville clay loam	.262	.193	814	2.46	1.06	1173	2.52	4.53	7.5	0-7
25894	Raymondville clay loam	.130	.164	713	2.31	1.05	848	4.52	2.40	7.5	7-19
25891	Raymondville fine sandy clay loam	.136	.118	424	2.31	1.06	1113	1.37	2.51	7.3	0-7
25892	Raymondville fine sandy clay loam	.096	.116	332	2.46	1.04	918	2.74	4.83	7.4	7-19
25881	Victoria clay	.110	.151	624	2.82	----	971	----	1.95	7.5	0-7
25882	Victoria clay	.070	.114	570	2.99	----	750	----	2.82	7.8	7-19
25779	Victoria clay loam	.109	.192	484	2.57	1.07	998	2.52	4.10	7.6	0-7
25780	Victoria clay loam	.070	.170	196	2.38	.88	678	6.34	11.40	7.6	7-19
25867	Victoria clay loam, salty phase	.083	.108	590	2.85	----	721	----	3.35	7.8	0-7
25868	Victoria clay loam, salty phase	.053	.134	742	2.94	----	666	----	5.66	7.8	7-19
25887	Victoria clay loam, light-colored phase	.159	.129	415	2.97	.92	1133	.70	1.55	7.3	0-7
25888	Victoria clay loam, light-colored phase	.119	.094	244	2.94	.90	913	1.16	2.11	7.5	7-19
Average	Victoria fine sandy clay loam	.134	.072	202	2.40	.68	886	.67	1.21	7.4	surface
Average	Victoria fine sandy clay loam	.082	.046	41	2.49	.79	561	.51	1.11	7.2	subsoil
Average	Victoria fine sandy loam	.123	.096	294	2.11	.75	951	.60	1.36	7.4	surface
Average	Victoria fine sandy loam	.067	.074	248	2.52	.45	752	1.05	2.11	7.5	subsoil
Average	Willacy fine sandy loam	.104	.041	95	1.67	.32	625	.45	.79	7.2	surface
Average	Willacy fine sandy loam	.061	.029	38	2.15	.36	497	.41	.60	7.1	subsoil

Table 26. Interpretation of analyses of surface soils of Willacy county

Laboratory number		Corn possibility two million pounds			Total phosphoric acid	Acid-soluble potash	Acid-soluble lime
		Active phosphoric acid	Total nitrogen	Active potash			
25871	Dune sand	6	8	38	low	fair	good
25905	Laredo silt loam	45	23	273	good	good	high
25901	Lomalto clay	45	33	290	good	good	good
Average	Lomalto clay loam	45	13	219	good	good	good
25873	Lomalto fine sandy loam	24	18	61	low	fair	fair
Average	Nueces fine sand	12	13	73	low	good	good
25877	Point Isabel clay	45	23	154	good	good	high
25869	Point Isabel fine sandy loam	50	18	196	good	good	high
25897	Point Isabel fine sandy loam, high phase	45	28	286	good	good	good
25893	Raymondville clay loam	65	63	306	good	good	high
25891	Raymondville fine sandy clay loam	55	38	306	good	good	good
25881	Victoria clay	60	33	304	good	good	high
25779	Victoria clay loam	55	33	306	good	good	high
25867	Victoria clay loam, salt phase	55	28	262	good	good	high
25887	Victoria clay loam, high-colored phase	55	43	306	good	good	good
Average	Victoria fine sandy clay loam	50	38	294	good	good	good
Average	Victoria fine sandy loam	50	38	304	good	good	good
Average	Willacy fine sandy loam	40	33	239	good	good	good

Table 27. Pot experiments on soils of Willacy county

Laboratory number	Type name	Weight crop in grams				Corn possibility of plant food withdrawn, in bushels		
		With complete fertilizer	Without phosphoric acid	Without nitrogen	Without potash	Phosphoric acid	Nitrogen	Potash
25779	Victoria clay loam, surface, corn	26.5	24.8	11.4	29.5	54	19	634
"	Victoria clay loam, surface, kafir	34.9	34.2	6.3	33.4	51	13	440
"	Victoria clay loam, surface, cotton	22.7	21.0	21.5	13.0	64	31	304
25780	Victoria clay loam, subsoil, corn	25.7	9.5	10.6	26.0	18	17	35
"	Victoria clay loam, subsoil, kafir	36.5	31.0	14.3	4.4	25	8	335
"	Victoria clay loam, subsoil, cotton	18.5	16.4		17.5	31		34
25781	Victoria fine sandy loam, surface, corn	29.2	29.3	30.9	29.5	66	70	826
"	Victoria fine sandy loam, surface, kafir	46.5	43.5	12.0	43.0	60	24	525
"	Victoria fine sandy loam, surface, cotton	22.0	20.1		21.0	66		339
25782	Victoria fine sandy loam, subsoil, corn	24.3	18.7	20.1	31.2	30	35	643
"	Victoria fine sandy loam, subsoil, kafir	43.1	26.5	5.2	42.4	28	10	419
"	Victoria fine sandy loam, subsoil, cotton	18.5	16.8	16.2	18.7	22	47	253
6731	Victoria fine sandy loam, perhaps, surface, corn	57.8		37.0			45	
"	Victoria fine sandy loam, perhaps, surface, sorghum	31.5		7.3			15	
6732	Victoria fine sandy loam, perhaps, subsoil, corn	34.6		22.9			3	
"	Victoria fine sandy loam, perhaps, subsoil, sorghum	34.4		4.0			7	
25786	Willacy fine sandy loam, subsoil, corn	28.2	15.5	19.8	36.1	22	37	392
"	Willacy fine sandy loam, subsoil, kafir	43.3	25.0	5.5	41.3	21	10	314

Flat Stream Bottoms Subject to Overflow:

Brown, calcareous friable topsoil with brown or yellow, calcareous, crumbly subsoil—Laredo soils.

Semi-marshy and Associated Soils:

Brown, calcareous, friable wet salty land on flat coast border with brown or gray, calcareous, subsoil with high water table—Lomalto soils.

Gray to ash-brown, calcareous, salty friable topsoil on flat to dune-like ridges, with yellow, calcareous, salty, subsoil—Point Isabel soils.

Dark-brown, black or ash-gray calcareous topsoil with dark-gray or black heavy calcareous subsoils—Tiocano soils.

SUMMARY

Chemical analyses and pot experiments on samples of typical soils from 8 counties are described, with interpretations of the results. Some of the soils are low in nitrogen, and in phosphoric acid. They are better supplied with potash. Few are acid and many are basic or even calcareous soils. Condensed descriptions of the soil types are given, with detailed analyses.